Plates. { Drawings of Dwight H. Perkins.
Drawings of Charles Balderston.
Measured Drawing of Italian Brickwork, by James P. Jamieson.

THE BRICKBVILDER

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DEVOTED TO THE INTERESTS OF ARCHITECTVRE IN MATERIALS OF CLAY

PUBLISHED MONTHLY.

85 WATER STREET, BOSTON, MASS.

VOLVME FIVE

OCTOBER MDCCCXCVI

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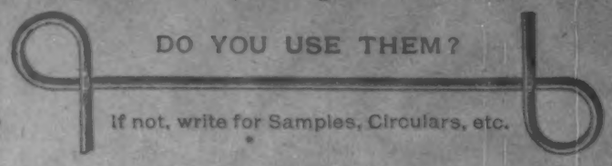

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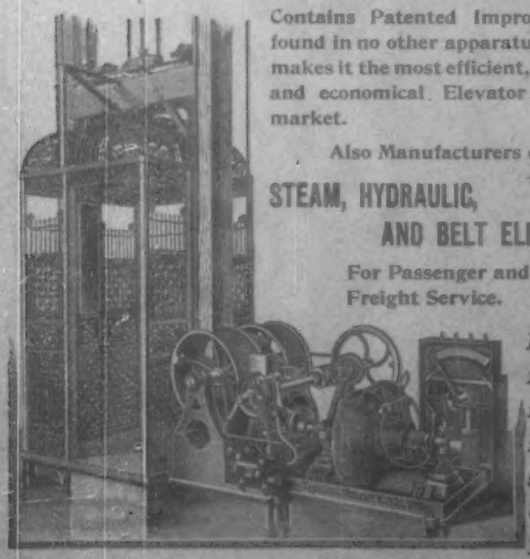

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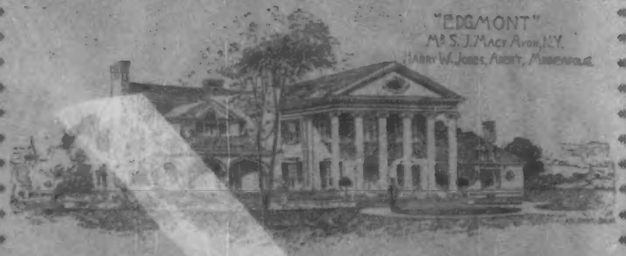

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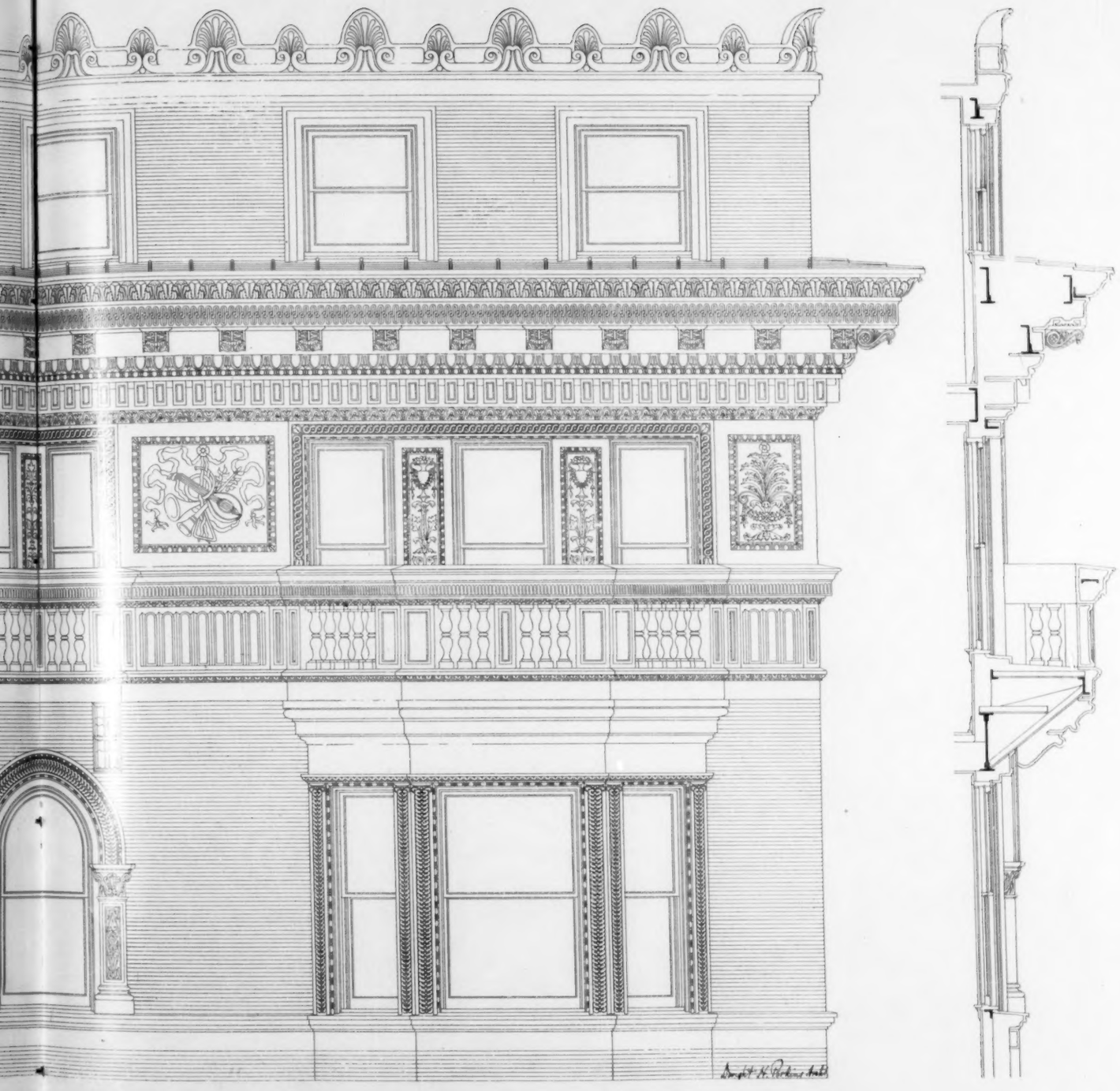

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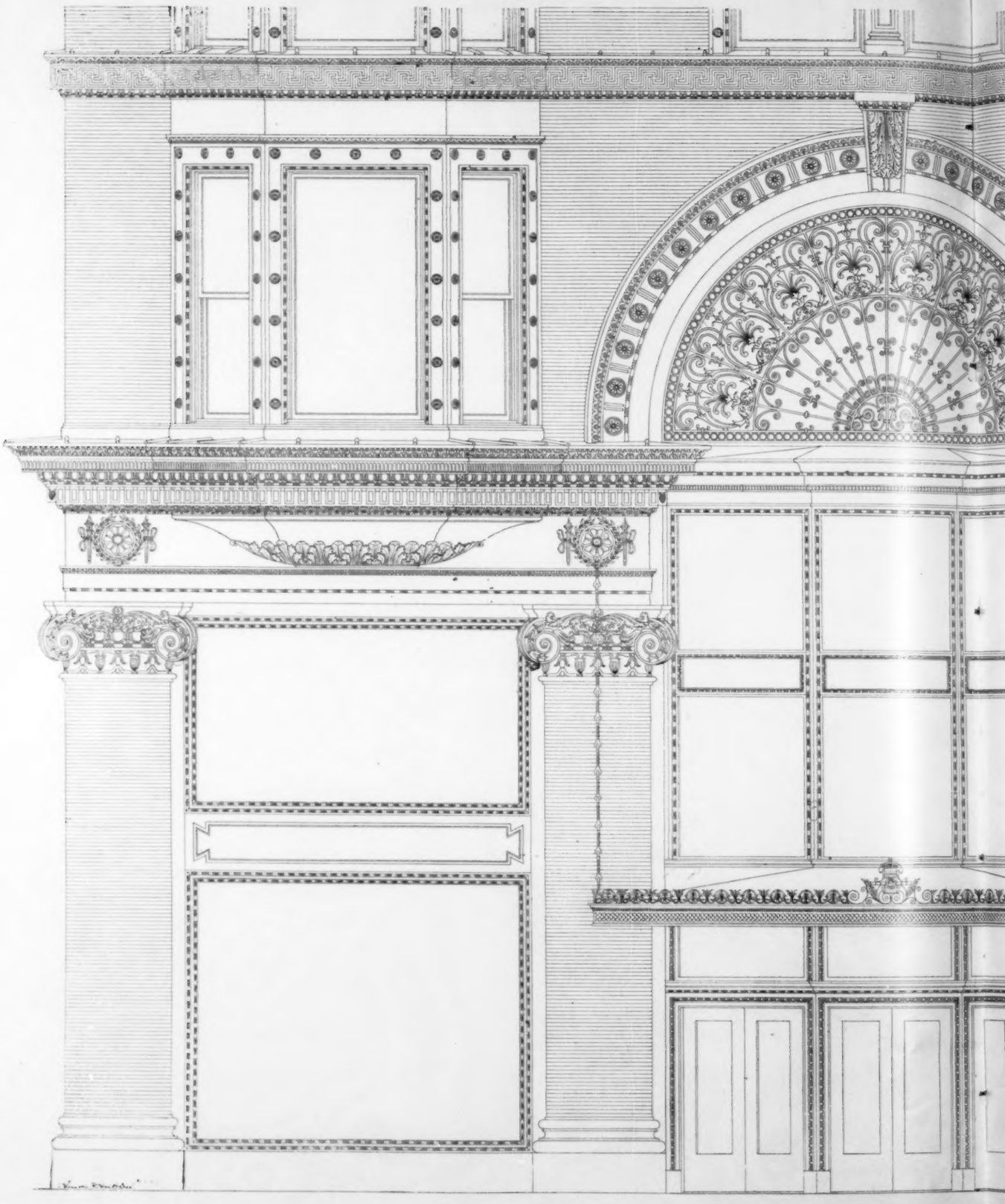

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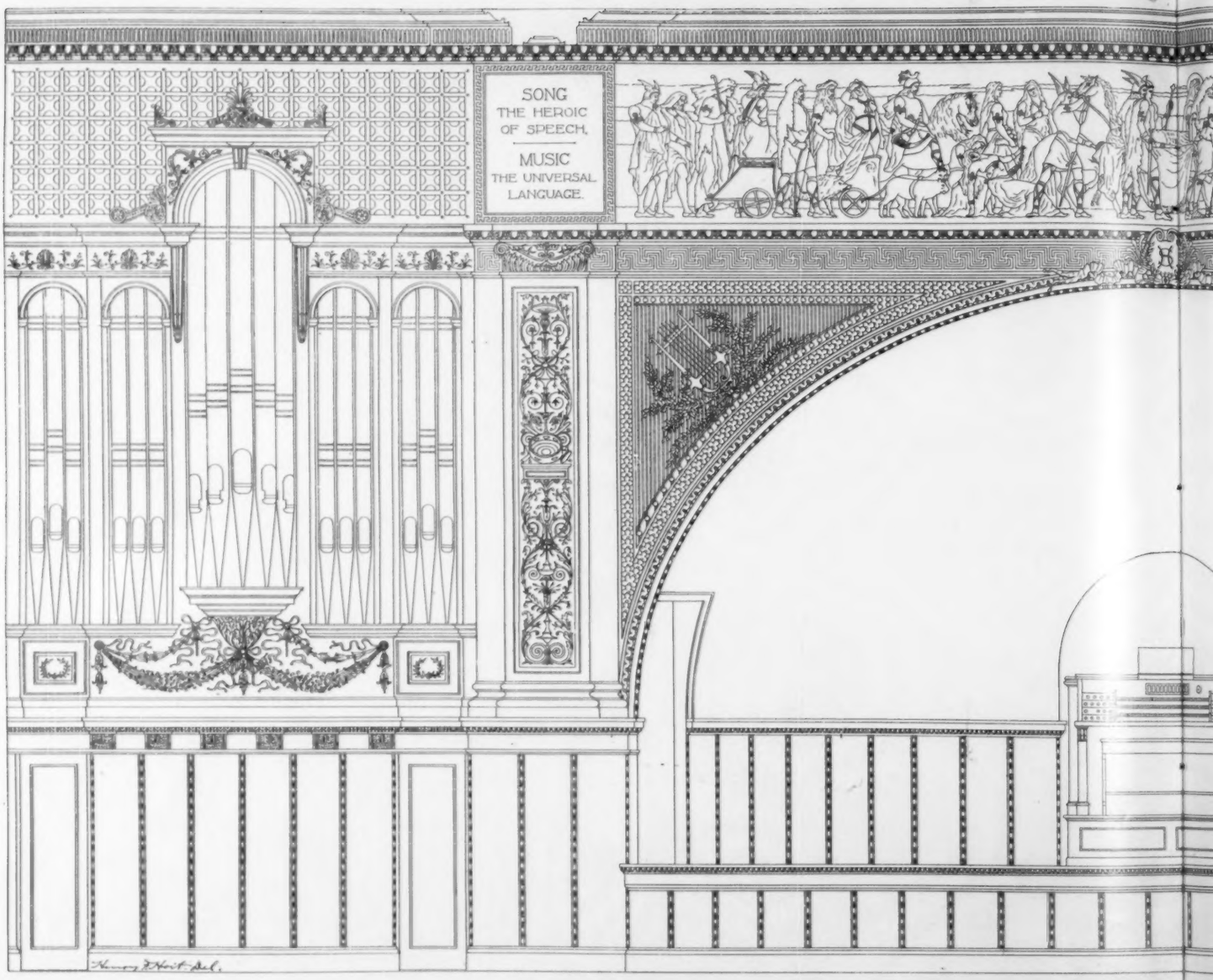

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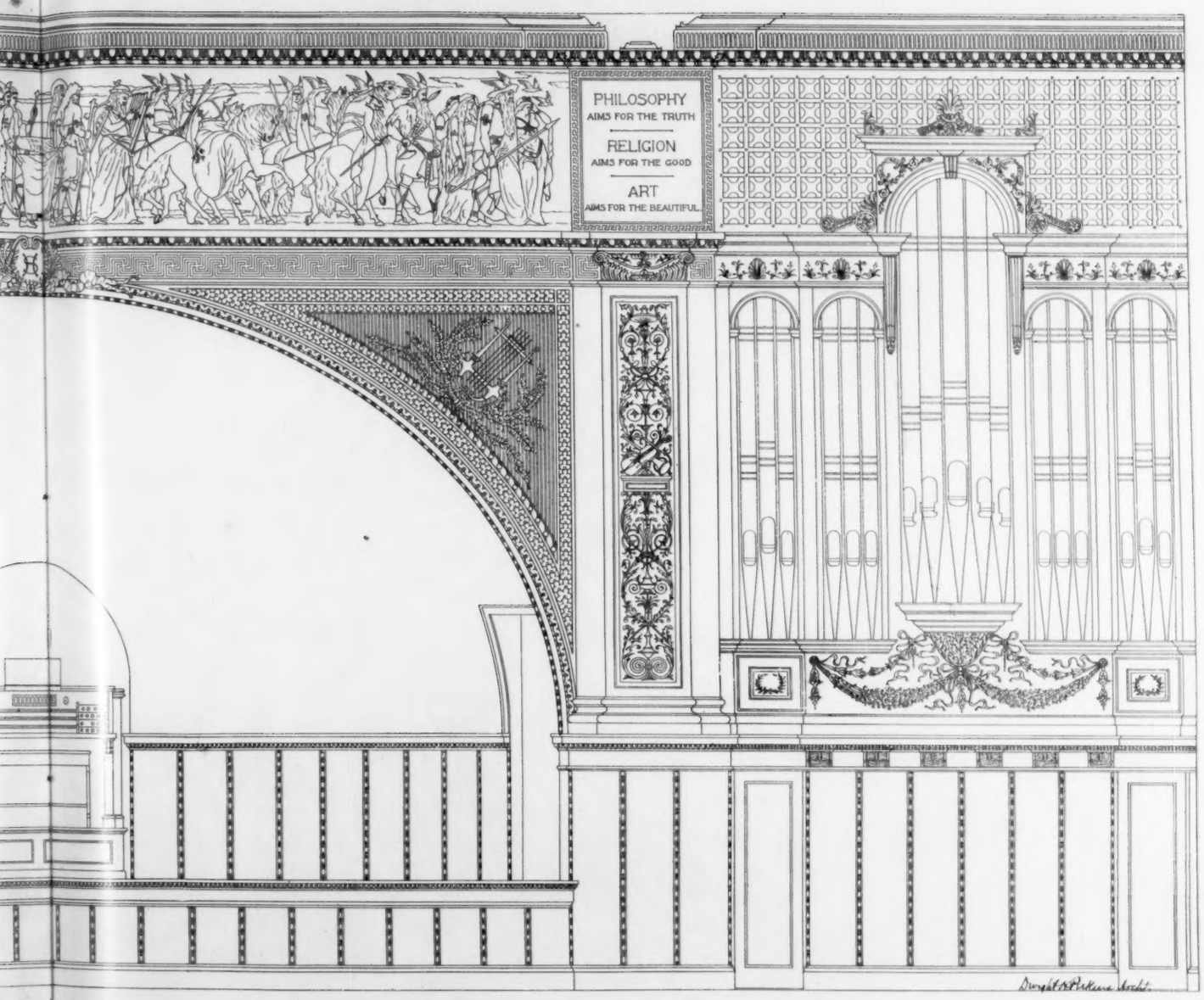

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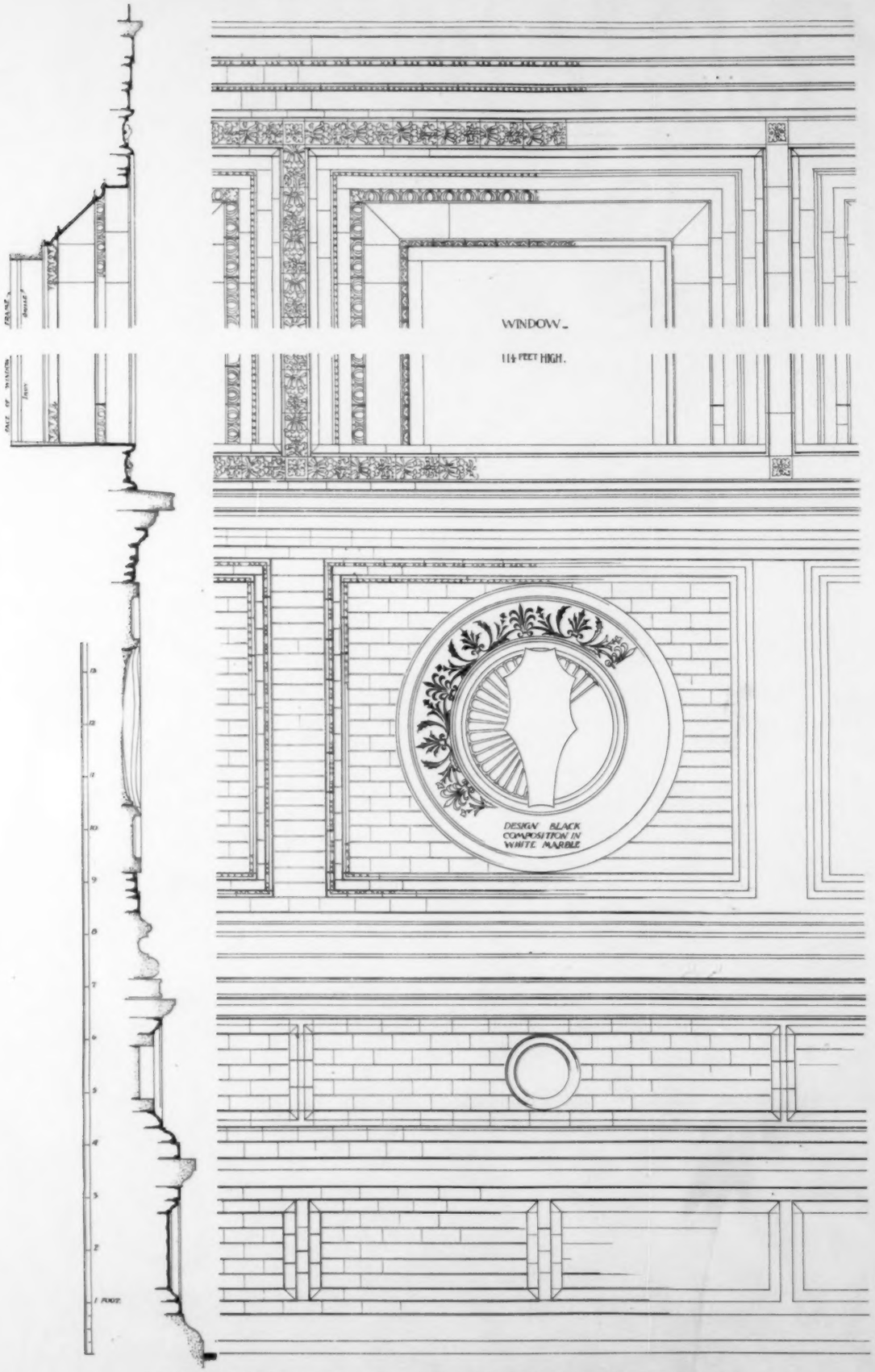

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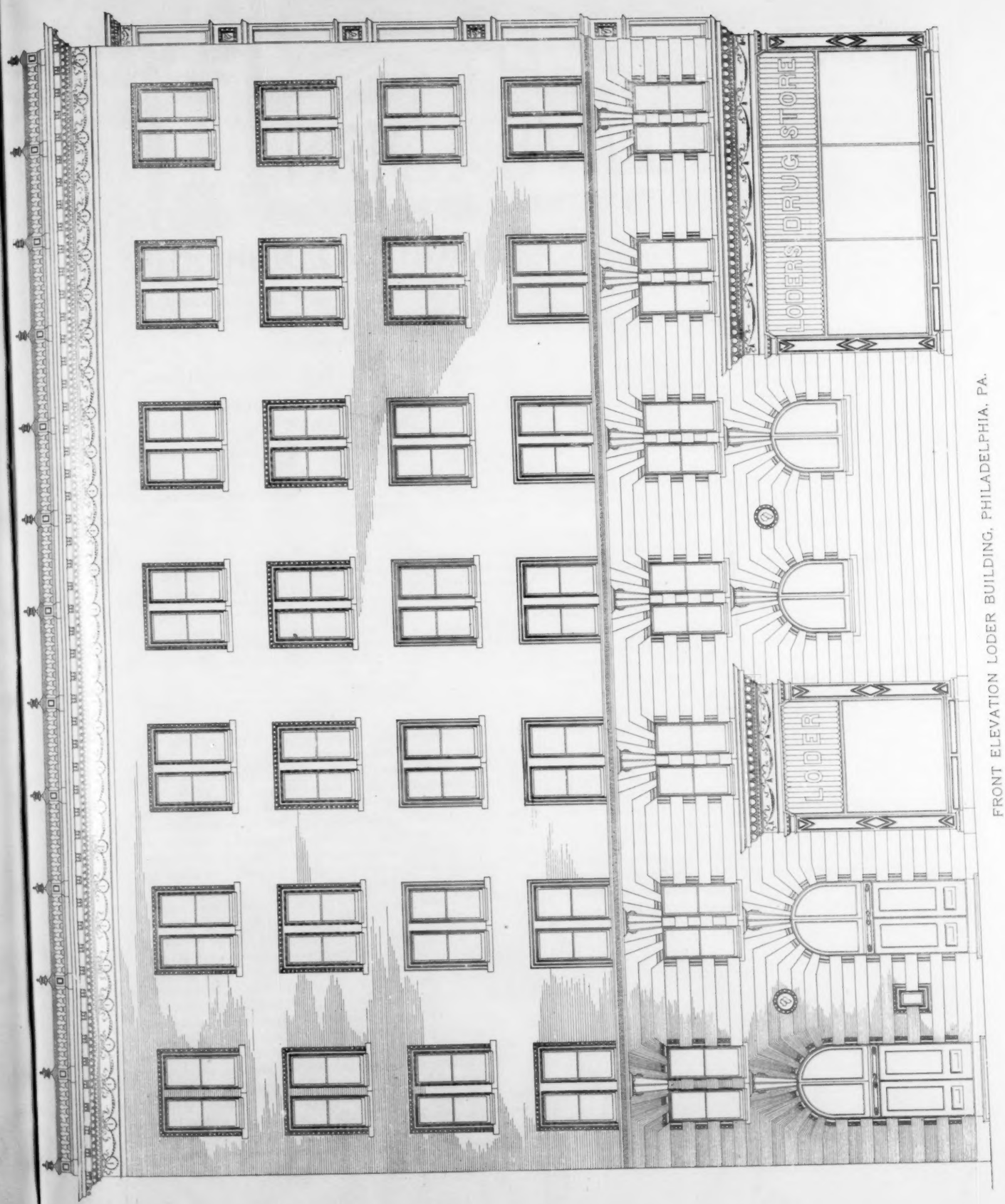

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VOLVME V OCT. 1896 No. 10

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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STYLE.

THE editorial in our September number, considering the subject of imitations in building material, drew attention to the essential characteristics which should distinguish terra-cotta from stone work. The nice observance of these distinctions and their application to executed work form a very considerable element in the indeterminate quantity which goes to make up what is termed "style" in architectural design, and which in its broader artistic sense constitutes the intrinsic merit of a composition and marks the vital character which we would wish to have associated with the work at its best. Style may be not inappropriately defined as the mark of the essential moral character and conscious creative rectitude evinced by the artist in his work. In this respect it is entirely distinct from fashion or usage. The Parthenon possesses real style; the works of the Della Robbias are full of it; and no one can study the beauty of a Greek antefix or one of Botticelli's paintings without being keenly conscious of a quality running through both, similar in spirit though totally different in manifestation, a sense of innate refinement and of conscious purity which we designate as the style. Now style is something that is often wofully lacking in our modern work. With our retrospective habits, our tricks of borrowing lavishly from all of our artistic ancestors, and our opportunities for mechanical production, it is very easy to lose the touch, the sentiment, which would elevate our work to the dignity of an art as distinguished from a mere science or manufacture. Our stone architecture and our woodwork we can copy line for line, and can set up photographs before our mechanics, and impart a very strong flavor of classic antiquity to our details, when both material and design are copied literally; but to give burnt clay the proper terra-cotta look, to produce ceramic work which shall be *sui generis*, we must infuse in our design the individuality of style which will stamp it properly and give it the right flavor.

Style does not always come by seeking; an appreciation for it is a matter of temperament as well as education, and all designers do not succeed in equal measure in imparting real style unto their productions. But while a talent for an art is rare, it is given to every one to cultivate the taste therefor, and in proportion as we strive to infuse a more genuine appreciative style into our work, to refine it, to make it true to the material and natural in its manifestations, just in that proportion will our art be enjoyable and the product be such as can rank with the best of the work of the past which we are now so eager to copy. The fact that terra-cotta is so truly the result of the personal manipulation of the artist, and that it receives so immediately the touch of the designer's hand, has been no inconsiderable factor in winning for it the acknowledged artistic position which it occupies to-day. There is no building material which catches the artistic inspiration so truly and retains it so happily as terra-cotta, and we are much more apt to find true style manifested in architectural design as represented by the burnt-clay industries than in a material which to be wrought in execution has to be laboriously cut, hammered, and carved into place, or worked over through the mangling operations of patterns, molds, and castings.

It is easier to illustrate manifestations of style than to exactly determine a quality which owes its existence to individual taste. In the latter part of the last century and the early part of the present, a number of brick country dwellings were erected in the neighborhood of the Potomac Valley, forming a group of manor houses which in their way have seldom been equaled, and never thus far excelled as examples of quiet, refined, domestic architecture. These throughout in their design and arrangement, as well as in their interior finish, possessed emphatically the *cachet* of good style. They were inspired very largely by the work of the preceding period in England, and were the outcome of the education and refinement which was so peculiar to the section of the country at that period in our history. Compare these simple, beautiful buildings with the ostentatious elaborations which mark the domestic brick architecture of the period immediately following the Civil War, when Swiss *châlêts*, Italian villas with sanded fronts and pagoda-like towers, and four-inch brick veneered constructions applied over wooden boarding were considered in good taste. The dullest intellect cannot fail to appreciate that the Virginia homesteads possessed real intrinsic style, while the latter structures were utterly, hopelessly commonplace and vulgar. And coming to more recent times, compare the crude factory-like masses which have resulted from the attempts to build warehouses or factory buildings with the few isolated examples, such as the Boston Storage Warehouse, designed by Messrs. Chamberlin & Whidden. In both constructions the problem is identical, the material is the same, the cost not essentially different, but the difference in the results is as marked as that existing between the Virginia homes and the shoddy brick shanties of pre-centennial times. One is nothing but a simple mass of brick, unrelieved, and without an idea or suspicion of anything like thought, style, or dignity, while the other is as truly in good style and full of art impulse as the historic monuments of the

past. H. H. Richardson used to say that it was one of his ambitions to build a big grain elevator. He would probably have added a brewery. In many respects these are among the most interesting problems of brick design, but as customarily treated they are hopelessly unsuccessful. No attempt is made to take advantage of the magnificent possibilities of wall surface, contour, and picturesque outline which each presents in so marked a degree. Some day a master hand will get at both these types and solve them in so striking a manner, with so marked a dash of style, spirit, and artistic conception, that we will wonder why such constructions were ever considered as necessarily hideous.

THE PASSING OF THE CARPENTER.

AN interesting chapter might be written upon the passing of the carpenter. The time was in this country when the function of the mason was limited to cellar work and plastering, with a few chimneys incidentally introduced in the framework, which was essentially carpenter work. It is only a few years since general contracting was almost entirely in the hands of carpenters, and the masons were sub-bidders. But we have changed all that with the extended use of brick, so that now in a thoroughly modern up-to-date, first-class building carpenter work is reduced to the barest minimun, and the most successful of our large general contractors are the masons rather than carpenters. In the best of our office buildings the only woodwork remaining is in the shape of window frames and sashes. We have iron doors and frames, terra-cotta or marble dadoes and bases, and solid masonry floors supported upon iron, and wooden finish of every description is sedulously eschewed. Even the window frames and sashes bid fair to be supplanted by constructions of metal. Fortunately for the carpenter, and also unfortunately for the insurance companies, the wooden residence is still with us, but we hope to see this type of building transformed, and even detached houses throughout our suburbs constructed in part, if not wholly, of brick and terra-cotta.

TWO EXTRA PLATES FOR OCTOBER, NOVEMBER, AND DECEMBER.

THE issues of THE BRICKBUILDER for the remaining months of the year will contain two extra plates.

By making this addition to our plate form, we are in hopes to publish most, if not all, of the drawings promised in our Prospectus for the year, very nearly all of which we now have in hand. Delays in the preparation of drawings for publication have been our chief obstacle, although a consistent effort has been made to not only carry out our program as announced, but to present to our subscribers selected drawings from the best offices in the country.

Should circumstances warrant, we shall continue the two extra plates during 1897.

Subscribers will confer a favor by not sending to us drawings for publication that have not been solicited, for the reason that we have already made arrangements for much of the work that we shall publish next year, and having made our plans in advance, we have been obliged to decline many interesting and excellent drawings for want of opportunity to publish.

CLUB NEWS.

CHICAGO ARCHITECTURAL CLUB. On Monday evening, September 28, Lucy Fitch Perkins discussed the "Artistic Possibilities of Chicago" before the members of the club.

In the call for the meeting it was stated that every member would be expected to be prepared to answer the question: What would you do to beautify Chicago?

The annual election of officers was held on Monday evening, October 5. Richard E. Schmidt was elected president, and Arthur G. Brown, secretary.

On Monday evening, October 12, the retiring officers, Messrs. Dean, Garden, Lilleskan, and Hunt, entertained the members of the club.

At the first regular meeting of the year 1896–97, held October 19, the lists were opened for classes in architecture, pen and ink, and water color.

The Eighth Annual Competition for the Robert Clark Testimonial, held under the auspices of the club, is announced.

The subject is,—

A BATH HOUSE FOR A SMALL CITY.

The building is to be placed in the City Park.

It shall not be more than 200 ft. in its greatest dimension.

It shall consist of one story and basement. The first story shall contain the following rooms: A large hall for conversation and the promenade; it may be lighted from above. Two lounging or reading-rooms, one for each sex. These rooms shall communicate with the bathing departments, each of which shall contain the following rooms: Plunge-room containing a basin of about 1,500 sq. ft. area,— it should be lighted from above; attendants' and checking-room; towel and suit-room; about fifty dressing-rooms; about ten bath-rooms; one toilet-room.

The competition is open to architectural draughtsmen under thirty years of age, residents of the United States, and not practising architects.

THE ST. LOUIS ARCHITECTURAL CLUB held its monthly meeting on Saturday evening, October 3, and after the routine business enjoyed lunch, which was provided by Messrs. Deitering, Farrish, and Dwyer. The club, at the September meeting, decided to enter upon the winter's work at once, and since that time the class in architecture, under Mr. A. Guissart, and the class in pen and ink, under Mr. Oscar Enders, has been meeting regularly on Thursday and Saturday evenings respectively, excepting that on Thursday evening, October 8, the members laid aside their T square to attend the wedding of one of its members, Mr. Ed. Marquardt.

Much more earnest enthusiasm is being manifested by the members than at any time within a couple of years, and the club is in a flourishing condition.

ILLUSTRATED ADVERTISEMENTS.

THE adjoining spandrel is one of four, all bearing various heraldic devices, and will be used between the first story arches of the Tremont Street elevation, on the Pavilion Building, Boston. There will be another front on Pemberton Square, in which terra-cotta is used extensively, but less elaborate in point of detail. Messrs. Burr & Sise, Beacon Street, Boston, are the architects, and the work is being executed by the New York Architectural Terra-Cotta Company.

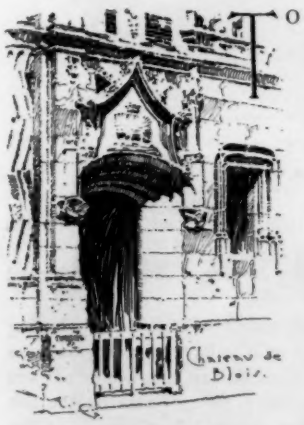
The design shown in the company's advertisement for this month, on page xxviii, is the one submitted by Mr. D. C. Meyers, Williamsport, Penn., in the competition held by this company, and which took fourth prize.

FARM HOUSE NEAR CHATEAU
CHAUMONT, FRANCE.

Architectural Rendering in Pen and Ink.

BY D. A. GREGG.

PRINCIPALITY AND REPETITION.



TO properly follow my previous article in THE BRICKBUILDER, I should now give attention to shade and shadow, or values; but these we will put aside for the present and consider composition in one of its phases, principality, and repetition.

I will not dispute very seriously that with some the artistic sense may exist to such a degree that in pictorial composition they intuitively do the right thing every time. But that such minds operate totally without rule I quietly doubt. There may be an arrangement of words, but some standard of correctness exists which could be put into words if the happy possessor cared to do it.

Possibly I mistake in supposing that any one says there are men and women so gifted. But there is an impression in my mind that it is believed by some.

It can easily be understood how a young artistic mind would avoid the consideration of rules, and make no effort to look them up, dry, mechanical, distasteful things, of the same class as rules in mathematics. And truly a poor artist would he become, who, at the beginning, studied on that line instead of going direct to nature herself.

But study nature for awhile, a long while, and some day try a composition of your own. It will probably not be long before a conviction will unpleasantly creep over you that some of the difficulties met are not trifling, effects don't satisfactorily arrange, and you hail with delight anything, whatever name you may give it, that will straighten matters out.

In my acquaintance with artists I have had evidence enough times to convince me that all have ideas in composition, picked up somewhere, from a book or from a friend, or, better than either, from hard, thoughtful experience, that are invaluable in their work. These are their "stock in trade," best used by the possessor himself usually, because thoroughly thought out, tried and proved.

I remember with gratitude a Mr. Edward Wimbridge, in New York, a talented English artist, one of the first illustrators on stone, of the London *Building News*, with whom I fortunately became acquainted in my early draughtsman days.

More than once when struggling over a rendering I have gone

MANOIR AT LE RUESNOY, NORMANDIE.

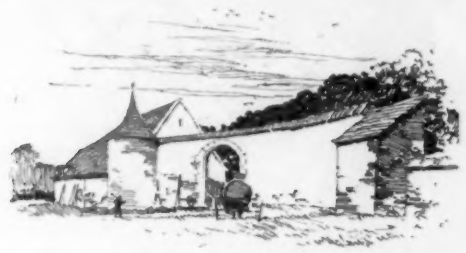
to his house in the evening to get advice; and he not only gave advice, but would sketch, wash in a sample sky, or do anything else necessary to help his young friend out of the strait.

Often since has his generous gift of valuable information encouraged me toward similar generosity, when the natural impulse might have been "keep it for yourself."

I recall that he mentioned this matter of principality, but I was

not in a condition to feel its need until a year or two later, when again it was brought to mind by reading Ruskin's "Elements of Drawing." By that time its value was appreciated, and though I used it badly and awkwardly for awhile, experiment and experience finally brought it into excellent service.

There is reason for hesitating to offer with much urgency anything like a rule in composition until such advice is really wanted,



BARN AT CHATEAU EPREVILLE, NORMANDIE.

and it is best at first for the student not to be bothered with them. Nature first, by all means.

Beginners do well to be even skeptical of helps. Try them, if you will, when you feel the need, and when you have tried and proved them, they are your good servants, and will serve you well. At first a rule is too apt to be the master.

We do not have to go far to discover in the Creator's work use of this thought of principality and balancing repetition. Look at your hand. You may observe it in two ways; the palm or body of the hand is principal, the thumb is a large repetition, the fingers other smaller ones. Or consider the fingers themselves; the middle one principal, two fingers on one side, a finger and the thumb on the other side repeating. But these two groups are beautifully unlike, and altogether form a most interesting example of principality, variety in repetition, and perfect balance of parts.

There are instances in an artist's work where an unrestful impression is wanted, as perhaps in the representation of a battle scene, but generally, whether in a pictorial way or in design architectural or decorative, the effect desired is restfulness, repose, a quiet, simple result, grandly quiet if possible. To obtain this many things contribute, but the two items under our consideration are not of the least importance in the matter.

To clothe the thought in words, it may be put in this way: —

Any arrangement of form or values comprised in a picture or group should be so composed that the observer will easily look over the whole composition, but finally and always come back to some leading effect, stronger and more conspicuous than any other.

If the artist be wise, he will see to it that this principal interest is connected with some important part of the subject to be illustrated.

This principal effect may be a dark or a light, or be principal because of its superior size. There may be also in the same picture both dark and light as leading effects, for dark and light do not compete with one another.

There should be no competition for interest. If there are two or more strong points in any composition so equally attractive that the eye goes from one to the other and cannot rest on one of them finally as superior in interest, there is no repose. The intuitive artistic sense, or trained judgment, comes in right there to subdue this one, or pronounce that a little more, till one of the competing points takes proper precedence.

Good judgment will not overdo this by making the emphasis so loud that nothing else can be seen or heard but the principal effect. When best used it will not be very apparent, but, nevertheless, will exist visible to the eye of the observer who understands, and if the observer does not understand, he gets the impression which the artist intended to convey.

The very word "principal" suggests repetition. A large dark effect or principal form should have one or more smaller ones to repeat it to prevent a bold, staring rudeness in the principal one. These repetitions must not be forced or methodical. Neither principality nor repetition should give itself away.

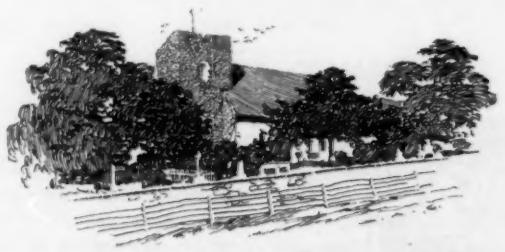
The drawing at the head of this article, *farmhouse near Château Chaumont*, illustrates our topic. The tree leads both in its conspicuous form and in its strength of black. The tower and its shadow are its principal repetition. The dormer and the foliage low down on the right are other repetitions.

Observe how easily your eye rests on this tree. But try the tower top, look at it steadily, and note how strongly you are drawn to the tree. You cannot rest your vision on the tower without a little effort. Yet the tree is not so strong but that one can look over the whole drawing, but — will finally return to the tree.

This drawing also illustrates in one portion of it the value of repetition in the way of balance. The tower stands between two chimneys. In the photograph from which this drawing was made, the chimney on the left did not exist. Cover up this chimney and see if your eye does not call for it as a repetition of the tower, also as a balance to the chimney on the right.

In this drawing, beside its principal dark, is its principal light between the tree and the tower. On the right of the tree is a repetition, and on the left of the tower, and smaller ones here and there.

The initial cut *Château de Blois* is an example of a rather bold



CHURCH OF ST. MARTIN, CANTERBURY, ENG.

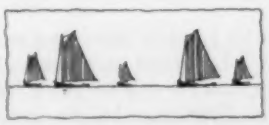
leading dark and repetition. One feels the want of another on the left, — a balancing repetition.

The two cuts following have, like the larger one, their principal dark and light.

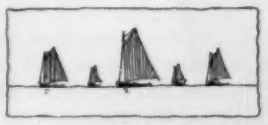
The church of St. Martin differs somewhat from these in having no principal light. It can hardly be said to have a leading dark, as the whole drawing is one mass of values, and so as a whole it is one dark value. But in its forms the large foliage mass on the left takes precedence agreeably. Imagine the middle tree to be of the same size as the large one; there would then be competition and consequent lack of repose.

This simple marine diagram again illustrates the topic quite completely.

BAD COMPOSITION. COMPETITION, AND NO REPETITION.

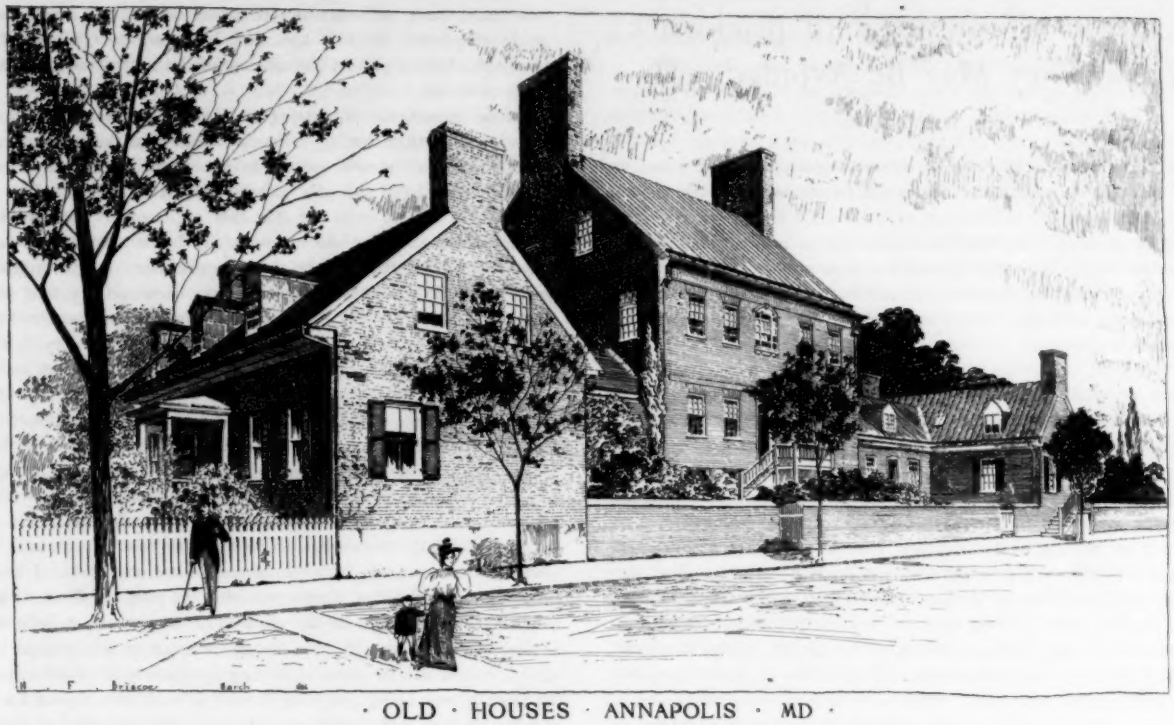


A LITTLE BETTER, BUT MONOTONOUS IN REPETITION.

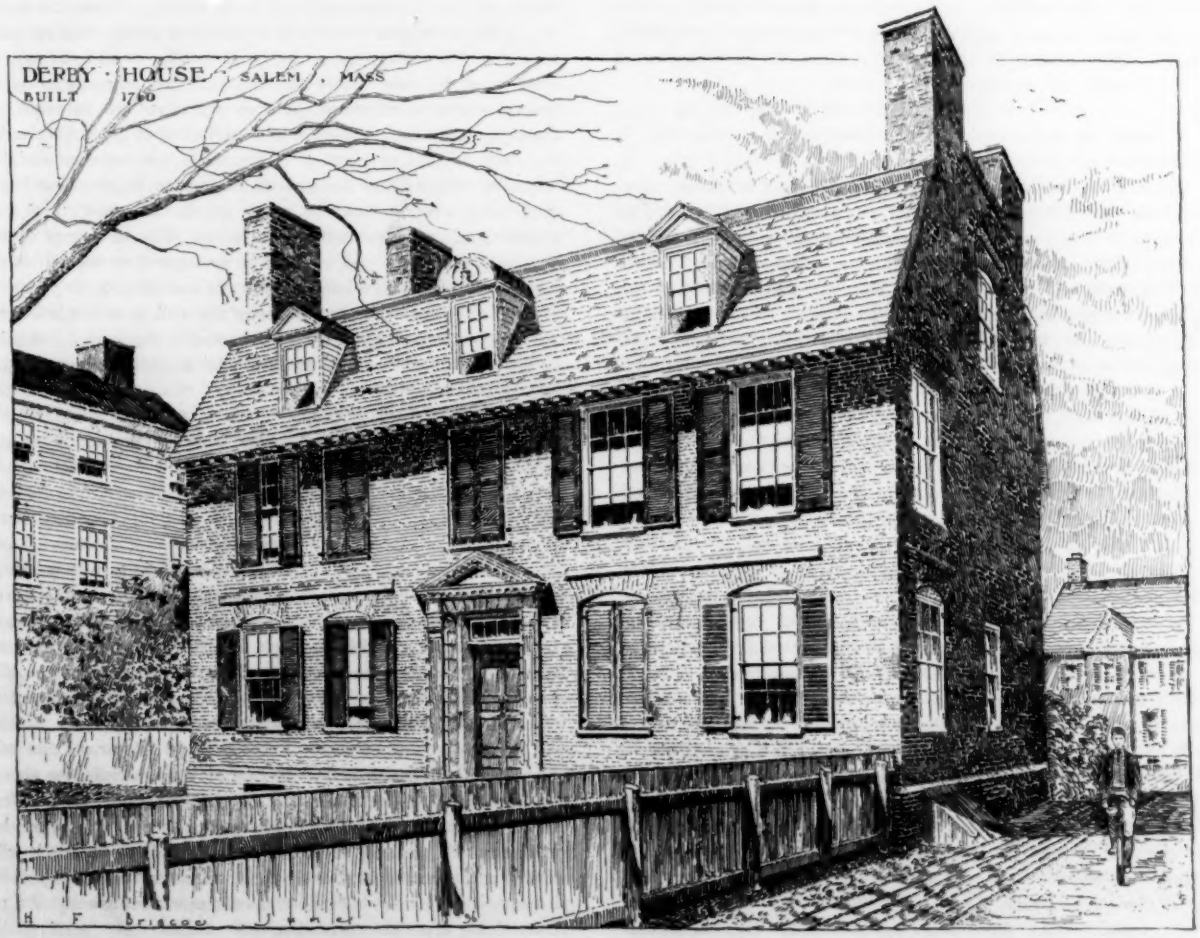


STILL BETTER, BECAUSE OF A PRINCIPAL OBJECT.

GOOD COMPOSITION PRINCIPALITY, WITH VARIETY IN REPETITION.



· OLD · HOUSES · ANNAPOLIS · MD ·



PEN AND INK SKETCHES OF OLD BRICK HOUSES, BY H. F. BRISCOE, BOSTON.

Architects' Troubles with Brickwork: How They May Be Avoided. II.

BY F. E. KIDDER.

IN a previous article the writer mentioned the most common troubles that architects meet in their endeavor to obtain a good job of brickwork.

How to avoid the troubles cannot be so easily told, but the writer has found by much experience that many of them can be overcome, at least to a considerable extent, and for the benefit of the inexperienced architect he will endeavor to show as well as may be how to avoid them.

In general, it may be said that all the troubles mentioned can be best provided against by a thorough knowledge on the part of the architect of all the details that relate to the manufacture and quality of bricks, and the necessary conditions for obtaining good mortar, and also of the way in which brickwork should be laid. With this knowledge, the architect should draw up his specifications in such a way that the contractor will know just what quality of materials he must provide, and just how the work must be done. The writer believes that *indefinite specifications* are too often the greatest source of trouble to the superintendent who is anxious to secure a good piece of work, as it is very difficult to get most contractors to do a better piece of work, or to furnish better materials than the *letter* of the specifications requires, and if the latter contains any loopholes, the contractor is quite sure to avail himself of them.

Another way in which these troubles may often be avoided is by giving the work to a conscientious and reputable contractor; unfortunately, the architect is not always able to do this, but is required by the owner to accept the lowest bidder; but the architect should use his influence to secure a contractor having a reputation for doing good work, whenever he can do so.

The various sources of trouble mentioned in the preceding paper will be taken up consecutively, and the way in which they may be avoided or overcome discussed.

POOR BRICKS. The architect must, as a rule, adapt his brickwork to the material available in the vicinity of the building, and as the quality of bricks varies greatly in different portions of the country, the architect must have a practical knowledge of the quality of the bricks made in the locality where he is to build, and also of the different trade classifications of the bricks. It then only remains to specify exactly the class of brick he wishes used, and to firmly insist that no inferior brick shall be delivered at the building.

In most localities it is customary to specify for the common bricks, "good hard-burned common bricks," and generally this is sufficient; but in some localities, as in Colorado, there is quite a difference in the bricks that would come within that classification, and it is necessary to be more particular in the specification. For the best common bricks, it is customary to specify an end-cut stiff mud brick, and that no red or salmon brick shall be used. It is also customary to limit the choice to two or three brick-yards. For dwellings where no great strength is required, a "good red brick" may be specified. The writer has often found it necessary to specify, "Should any soft or salmon brick be delivered at the building, they are to be immediately hauled away, and the architect shall have authority to stop the progress of the work until the condemned material is removed." This is sometimes the only safeguard where there is no "clerk of the works," because, if the bricks are allowed to remain at the building, they are quite sure to be worked in.

The young architect will find that the best way to get along with contractors who are inclined to use poor materials is to be very firm at the start, and to promptly condemn and demand the immediate removal of any material that does not come up to the requirements of the specifications.

With pressed brick there is not apt to be much trouble, as the particular make and grade of brick is generally specified, and these run much more uniform than common bricks. If a poor make or grade of pressed brick is specified, however, they will have to be accepted, as the architect cannot compel the contractor to get another grade or make.

The importance of wetting the bricks, and especially the common bricks, before laying, was emphasized in the previous paper, and the architect should be sure to specify that "all common bricks shall be well wet in the pile, except in freezing weather, just before being laid," and he must see that this requirement is complied with if he wishes to get a strong wall. If he is confronted with the statement that wetting the bricks is unnecessary, he can quickly disprove it by lifting a few bricks that have been laid dry, and showing that the mortar does not adhere to them. It is very seldom that the mortar will be found adhering to the bottom of a dry brick, but unless the mortar is very poor, it is sure to adhere to a wet brick.

LACK OF SUFFICIENT MORTAR. This is a trouble that is often hard to overcome unless there is constant superintendence. The specifications should require that "all common bricks are to be laid with a shove joint in a full bed of mortar, all interstices being thoroughly filled, and where the brick comes in connection with anchors, each one shall be brought home to do all the work possible." If, on the first visits to the work, it is found that this requirement is not being carried out, the architect should have a portion of the wall taken down; and if the joints are found only partially filled, he should condemn such portions of the work as he has reason to believe is in a similar condition, and give the contractor to understand that a similar course will be pursued as long as there is any indication that the work is not being properly done. A bold step should be taken in this direction at the very first, if there is any indication of the work being slighted. It is also a good plan to visit the work at different hours, so that the men may not know when to expect the architect. There are some contractors with whom these precautions are unnecessary, and there are a great many, the writer is sorry to say, whose work must be very closely watched, and the only way to deal with them is to let them see at the start that it will not be profitable for them to undertake to use poor materials or to slight the work. In the case of piers, or portions of the walls that have to sustain considerable weight, it is the writer's custom to require that the work shall be *grouted*, either in every course or every third course, according to the importance of the work. The advantage of this is, that while a grouted wall may not be stronger than one laid with wet bricks and a full shove joint, grouting is less likely to be poorly done, and it always shows on the surface of the wall, so that it is impossible to omit it without the omission being readily discovered. Again, the water used in grouting penetrates the bricks more or less, and causes greater adhesion with the mortar.

TO AVOID TROUBLE WITH THE MORTAR, a good quality of lime must be specified, and where lime is obtained from several sources, it is well to specify the particular source from which the lime is to be obtained. The sand should be sharp, free from loam, and not too fine or too coarse. It is a good plan to specify that "the mortar must be mixed to the satisfaction of the architect," and on the first visit an inspection of the materials and the mortar should be made, and it will be well to have a small batch of mortar mixed in the proportion of about one bucket of lime part to two of sand to serve as a standard. By making himself familiar with the appearance of this standard mortar, the architect will soon be able to tell at a glance, or with a trowel, whether or not too much sand has been used. There will be little danger of too little sand being used.

TO AVOID THE FADING OF COLORED MORTAR, one of the well-known high-grade brands of mortar color should be specified, and the superintendent must see that it is not mixed with freshly slaked lime, and that it is used in proper quantity. It is a good plan to have a little colored mortar mixed a few days before it will be needed, and to have a few bricks laid with it, so that the final shade of the mortar may be determined, as the mortar is usually of a much darker shade when wet than when dry.

To avoid crooked walls, the architect or superintendent should

frequently sight along the front of the walls and try the corners and jambs of openings with a plumb rule. A little trouble in this way will often prevent much vexation when the building is being finished. Where brick walls are built below grade, the architect should caution the contractor against filling against them until the floor joist above are in place, and the wall carried some two feet or more above them. A "green" brick wall will withstand very little side pressure, and the writer has known of serious trouble resulting from not observing the above precaution.

EFFLORESCENCE ON BRICKWORK. The appearance of a white efflorescence on the outside walls of brick buildings often causes vexation both to the architect and to the owner. The writer does not know of any practical way in which this can be absolutely avoided, as even where precisely the same materials are used, it may appear on one building and not on the others. About the only precautions that can be taken to prevent the appearance of the efflorescence before the building is finished is to select such bricks as have not generally shown a tendency to efflorescence and to use a lime that is free from magnesia. Too much wetting of the pressed bricks, the writer has observed, sometimes brings on the efflorescence, and it is therefore best to dip each pressed brick, for an instant only, in a bucket of clean water just before laying. After a building is completed, the efflorescence may appear and it may not. If it does appear, it can be washed off with clean water and a scrubbing brush. If it continues to reappear, the wall should be treated with oil, or some preparation, such as Cabot's Brick Preservative, that will render the bricks impervious to moisture.

CRACKS IN BRICK WALLS. The presence of cracks in brick walls is usually more the fault of the architect than the builder, as they are generally the result of an improper arrangement of the constructive features.

The various causes of cracks in brick walls and piers are:—

1. Insufficient or badly proportioned footings.
2. Shrinkage of timber built in the brickwork.
3. Unequal settlement due to compression in the mortar joints.
4. Overloading of the brickwork, and insufficient bearing plates.
5. Thrust of arches.
6. Poor material and workmanship, and insufficient bond.

Cracks are less liable to appear in a plain dead wall than in one pierced by many openings, and are also less frequent in brickwork that is laid in cement mortar.

Probably 50 per cent. of the cracks which are so often seen in brick buildings of only two or three stories are due to the first of the above causes. In large and important buildings the foundations are apt to be more carefully proportioned, and a better quality of material used, so that cracks are less frequent in such buildings.

For the ordinary brick building it is customary to continue the footings of the same width all around the building, regardless of openings in the wall, and wherever wide openings occur there is quite sure to be a crack in the wall below. Another common fault is that the foundations are not carried to a sufficient depth below the grade line. The manner in which cracks are produced by an improper arrangement of the footings has been so fully shown by Mr. A. H. Dyer, in the September to December, 1895, numbers of THE BRICKBUILDER, that the writer will merely refer the reader to those articles and recommend that they be carefully studied by the young architect.

There are still, however, a great many cracks that are not caused by settlement in the foundations, and most of these can be easily avoided by a little care and foresight in making the plans. In the portions of the country where isolated brick dwellings are most frequent, it is quite common to support parts of the brickwork by wooden timbers used as lintels, or girders. As it is practically impossible to secure thoroughly seasoned timber for such purposes, the girder or lintel is quite sure to shrink in the course of time, and a crack in the wall above, starting from the end of the wooden beam, is the inevitable result. If the architect, therefore, does not want cracks in his walls, he should never use wood for their support, and it is a good rule to place no wood at all in a brick wall, except as centers for relieving arches, and the ends of joists and girders. Even bond timbers and wooden bricks should be avoided.

Wherever a wall is considerably broken and rises to different heights, the effect of the compression of the mortar joints should be carefully considered. The shrinkage or settlement of lime mortar, although not very great, is still sufficient in a height of thirty feet to produce a crack, where the settlement is not uniform. When three or more windows are placed in a wall, directly above each other, it is quite common to see a crack in the stone sill of the lower window, if the sill has a lug, and very often a small crack in the brickwork above the lug. This crack is caused by the settlement of the brickwork at the side of the window. In such cases, it is a safe precaution to use slip sills in the lower openings. Brickwork laid in cement mortar settles very little, if any, and hence when cement is used, cracks produced by this cause are seldom seen.

First-class workmanship and materials and thorough bonding are also a safeguard against cracks, although they cannot be counted upon to offset bad designing.

Cracks due to overloading are less excusable than any others, as they can be avoided with certainty by properly proportioning the area of the wall or pier to the load, and by the use of bearing plates of proper size.

In conclusion, it may be said that to obtain a well-built brick building that will stand without cracking requires much more care and intelligence in laying out the structural features than is usually bestowed upon wooden buildings, and generally more thorough and competent supervision. While it is, perhaps, impossible to prevent an occasional small crack or some minor defect in the work, still, by carefully looking for the cause of such cracks as may occur, and by conscientiously following the suggestions that have been offered, the architect should be able to obtain for his client a very satisfactory and creditable building. A brick building, when well designed and built, is probably the most durable and satisfactory of all buildings.

BRICK FOR FOUNDATIONS.

IT is very commonly assumed that the only proper material for the foundations of a country house is stone in some form. Any one who has given the matter any thought, however, cannot but feel that stone in the rubble form, which is usually employed for house foundations, is anything but satisfactory. If the masons would carefully fill all the joints and thoroughly bond all the courses, and would lay up a wall with two faces so it would not catch surface water on external horizontal projections, there would be more in favor of a rubble wall; but as a matter of fact, the average house cellar wall is laid up partially dry with little dabs of mortar at intervals through the wall, and is then pointed after a fashion from within, and the exterior of the wall is left in a crude, unpointed state, while the bonding is so inefficient that very often the only thing that keeps the wall from falling out is the resistance of the external earth. From nearly every point of view brick would be far preferable for foundation work, provided a proper quality of brick were used. Nothing but the very firmest hard brick, and preferably one which was burned to vitrification, should be used for cellar work. A brick wall can usually be laid up more quickly than stone; it requires less labor on the part of the men to handle the material, and in case of wet or freezing weather the wall is less apt to be damaged. A 12 in., or, at most, a 16 in. wall of brick laid up with mortar, half lime and half cement, with the joints thoroughly flushed and the work bonded every five courses, would answer for foundation work a great deal better than even the best of rubble stonework. The price for thoroughly first-class rubble stonework in the vicinity of Boston is $4 per perch. A 12 in. brick wall would be equivalent in strength to the ordinary 20 in. rubble wall, and, consequently, a perch of stone would be the equivalent of 350 bricks, which, at say $17 per 1,000, laid, is nearly $6. In other words, the bricks would cost about 50 per cent. more than stone. The result, however, would be a far better and more satisfactory wall, and one which we are inclined to believe would be much more proof against dampness from the outside.

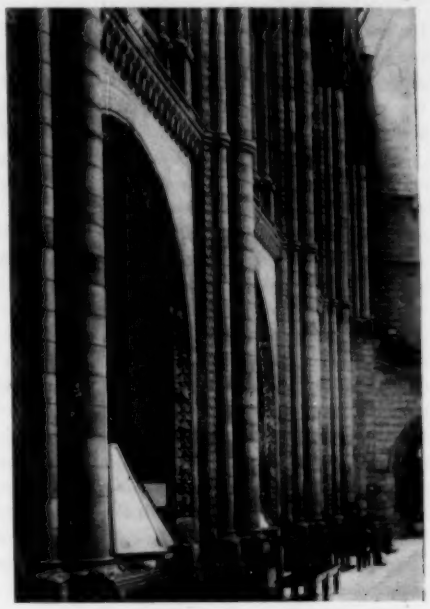
Architectural Terra-Cotta.

BY THOMAS CUSACK.

(Continued.)

IN the course of business correspondence with an architect some weeks ago, on the visibility or otherwise of mortar joints, and in relation to certain work then in course of execution, we took occasion to cite this building as a precedent, sending him a copy of one of these photographs in support of a similar contention. Said architect is known to us only through his drawings and very pointed written directions, from which we conclude that he is a man of taste and discernment, whose aim is to merit a high rank in his profession. The style of his work was a free rendering of French Renaissance, not without points of originality, and full of delicate ornament. This demanded close and neatly made joints, arranged in unobtrusive places, and, as he himself pointed out, had to be looked at from a somewhat different standpoint to that which would be applicable in work of a vigorous Norman or Romanesque character. In this view he was certainly correct, but, after all, joints are inseparable from construction, the one being a necessary corollary of the other. We have seen many attempts made to conceal them, but like similar subterfuges resorted to with the object of concealing the truth itself, they invariably resulted in failure, finally becoming known among workmen as "sham joints." We repeat that there can be nothing objectionable in a properly placed and skillfully made joint of, say, three sixteenths of an inch. It is only when ornament has been mutilated, and the edges of the blocks smeared with mortar by a slovenly workman, that the *alleged* joints become an eyesore sufficient to mar an otherwise excellent piece of work, on which care and skill had previously been expended.

Innumerable instances of joints as thick as the bricks themselves may, of course, be cited from well-known relics of Roman and medieval builders, but these are hardly applicable in the case of modern brickwork; unless, indeed, we accept their methods of construction, and build the whole of the wall as they would have done. With them, the greater portion of the wall was of concrete, forming a matrix into which the brick or tile was embedded. Each alternating course acted as a casing, and held the semi-liquid mass in position until it had set, when it became a veritable monolith. Not only were the walls of the Pantheon built in this way, but the dome itself, being so constructed, is without lateral thrust on its abutments; and now, after a test of two thousand years, there are no signs of spreading or of failure in the constructive features of this ancient but most enduring of architectural landmarks. The thick mortar joints were accepted as a concomitant of prevailing methods of building, but were not sought after, as in some quarters they appear to be with us, merely with the view to a supposedly picturesque effect. How people will follow the shadow, and forget all about the substance! Some architects are prone to the same kind of mistakes as physicians have been known to make, in treating the symptoms instead of seeking for the cause that produced them. They have not, as yet, so far as we are aware, got the length of deliberately leaving out a brick or two at regular intervals, in imitation of the putlog holes seen in the medieval brickwork of Italy and elsewhere. But the faddists among them appear to be retrograding rapidly in that direction. It is well to remember that "too far east is west."



EXAMPLE OF JOINTING, NATURAL HISTORY MUSEUM, LONDON.

Among the later instances of really good terra-cotta architecture in England may be mentioned the City Bank, Ludgate Hill, and the Royal English Opera House, Cambridge Circus, London, both of them by Mr. T. E. Colcutt. The color in each case is a tawny buff, with bricks of a darker shade. Architecturally the effect is at once appropriate and prepossessing, but on closer observation it will be seen that every detail has been worked out with scrupulous exactness. The setting of the work bears the indubitable evidences of care and deliberation, and the result is as nearly perfect as could reasonably be expected. On the subject of setting we shall have occasion to speak at some length in a subsequent chapter, but in passing, we are obliged to remark that in this important branch of the work, and in it alone, the English terra-cotta makers have a distinct advantage over anything to which we are accustomed in this country. The difference consists chiefly in the simple but fundamental fact that the British manufacturer sets his own work, and either employs directly a trained staff of skilled workmen, or sublets the setting to an experienced, responsible contractor, who in turn makes the business a specialty. Such a man has, by superior intelligence and industry, graduated from the ranks of workmen such as he employs. They are not, strictly speaking, stonemasons, nor yet bricklayers, but they have learned

THE ROYAL ENGLISH OPERA HOUSE, LONDON.

the art of setting terra-cotta "in a skillful and workmanlike manner," — words that are written or implied in every one of our specifications, — but how often are they enforced in every-day practise? Work that has been properly set redounds to the credit of the architect, gives satisfaction to the owner, and does simple justice to the material.

Work that has *not* been properly set — and of it we have a plenty — does the reverse of all this. The time must, and we believe it will come, when the terra-cotta manufacturers will no more think of allowing their work to be hashed by inexperienced and irresponsible setters than would the stone or marble masons. When that time comes we will be able to afford terra-cotta doorways, vestibules, and interiors, and we will then start on the first, instead of, as now, on the fourth story, as though our work had to be held a sufficient distance from the eye, merely to "lend enchantment to the view." Until then, terra-cotta will have to struggle onward and upward in the face of a few remaining obstacles to its complete success, and of which this one is now the most formidable. Formidable it undoubtedly is, but who will say that it is insuperable?

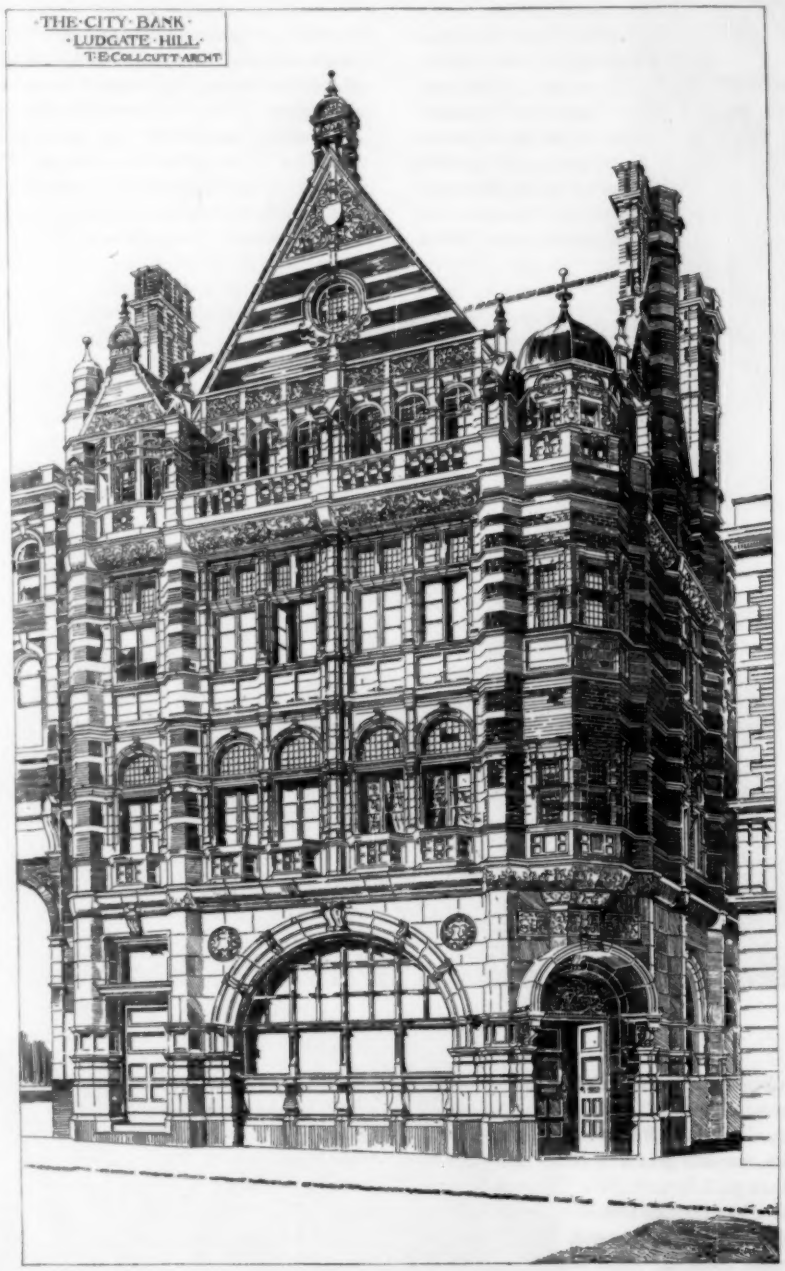
With the continued improvement of the manufactured article, and this obstacle removed, we, too, will gradually climb down to the street level, as they have done in England. We know of several instances where the experiment has been tried without experiencing any reason for regret. The very best one with which we are acquainted is on the Harrison Building in Philadelphia, where Messrs. Cope and Stewardson had the courage to submit the terra-cotta to this most crucial test. And taken as a whole, we have seen few better things on either side of the Atlantic. Mr. Sperry, of Baltimore, has done the same thing on the Brewers' Exchange now under way in that city. Mr. Charles Edwards has likewise followed their example in the Hamilton Club Building in course of erection in Paterson, N. J., and there are doubtless many more to follow. It but remains for the terra-cotta makers to show by the quality and finish of their work that they are equal to their opportunities, and these exceptional instances will become the precursors of a new movement.

The Victoria Law Courts, Birmingham, by Aston, Webb, and Ingress Bell, takes a front rank among the most successful and reassuring efforts yet made in burned clay. The color chosen for the exterior is a bright cherry red, and for the interior a yellowish buff: the former, we believe, from the works of Mr. J. C. Edwards, Ruabon, North Wales, where there are inexhaustible beds of a red-burning clay, unequaled, perhaps, for purity and uniformity. The extreme hardness and density of the blocks when burned have become a byword among terra-cotta makers. All attempts made to chisel the joints with the finest-tempered tools have been found impracticable. Hence the "fitting department," though universal with us, is unknown at Ruabon. It will be seen from this how necessary it is that every block should be geometrically and mechanically accurate in size and shape as it comes from the mold. Once burned, its destiny is sealed. If alterable at all, it is so to a very limited extent, and the best remedy is usually a remake, provided there be a sufficient margin of time before the work is wanted at the building. If not, the architect and builder will find themselves between the horns of a most exasperating dilemma. They will have to choose between a misfit or a month's delay, neither of which is likely to create a favorable impression of the material, or of the men responsible for the making and prompt delivery of it. There was a time, and of it we have a very lively recollection, when the most ludicrous blunders were of daily occurrence in the neighborhood referred to, and that, too, in the execution of work which would now be considered simple, if not elementary, and within the capacity of the veriest tyro. This state of things, we are glad to believe, is largely reminiscent. With new men have come new and improved methods, and the ability to handle more abstruse problems in draughtsmanship and construction, with a fair degree of success. Taking to themselves Hamlet's advice to the players, they have not only reformed it indifferently well, but have sought to "reform it altogether." Judged by the Birmingham Law Courts, we think that the manipulation of terra-cotta has reached a higher plane of intelligence at Ruabon during the past ten years than existed there previously. This must be gratifying to architects and others who believe in the future of a product that has hardly an

VICTORIA LAW COURTS, LONDON.

equal in point of density and brilliancy of color. Nature has certainly done her share in the extent and quality of the raw material.

The planning of this building was of course governed by the complex nature, as well as by the amount of accommodation which had to be provided in a center of legal and business activity second only to that of the metropolis. The grouping conforms closely in its main features to that of the strictly utilitarian plan; but in matters of detail, the architects being free and untrammeled, have made the most of their opportunities. The style approximates more closely to a phase of early French Renaissance than anything else we can think of, with the Gothic feeling somewhat accentuated. Yet the blending of the two distinct characteristics is so skillfully managed that one loses sight of the transition in the presence of a really pleasing, if not original, transposition. The air of unity and consistency that pervades the whole composition gives it a character of its own, with hardly a discordant note.



The three buildings that have been mentioned are, and no doubt will continue to be, the forerunners of others similar in style, and built of the same excellent material. They cannot fail to influence the architecture of the future, and will certainly stand as types of work of a purely native growth prevailing in the last quarter of the nineteenth century.

An extensive group of recent terra-cotta work may be seen within a short distance of Temple Bar. It extends throughout a number of streets from Essex Street westward to King's College, and from the Strand to the Victoria Embankment. In it we find offices, residences, hotels, and sundry business premises, including the famous book-selling establishment of the Right Hon. W. H. Smith, once First Lord of the Admiralty, and Conservative Leader of the Commons. The rebuilding of this colony, in which terra-cotta figures so prominently, has been carried out during the past few years. It is now a highly picturesque neighborhood, containing much that is of interest, but we think the desire to be ornate has been allowed too much license. The profusion of ornament is, if anything, overdone, and unnecessarily small members are introduced far too frequently. They serve no useful purpose, and but suggest the miniature proportions befitting a doll's house, rather than the homes of stern business realities.

A pleasant walk along the gardens of the embankment brings us to the National Liberal Club, which is stone, but Mr. Waterhouse has employed color faience and tile decoration in the dining and smoking rooms on an extensive scale, and in a way that is worth seeing. Turning into Whitehall, just opposite the Home and Foreign Offices, may be seen a specimen of refined terra-cotta that is probably unique in its texture and workmanship. The elaborate entrance, and indeed all the work on the first story, is so perfect in every detail that it took us some time to determine whether it was terra-cotta or Portland stone, to which some master-mason had given the finishing touches. The Constitutional Club, on Northumberland Avenue, for which R. W. Edis is responsible, we cannot help regarding as a wasted opportunity, both in design and execution, and one that it would be hopeless to palliate or deny. It is heavy, stupid, uninteresting, and encumbers one of the most desirable sites in London, within view of what has been described as "the finest site in Europe." Its presence, so near Trafalgar Square, is enough to make Landseer's lions unite in brazen protest. We were instinctively reminded of General Sheridan's laconic but significant rejoinder when asked his opinion of the Pension Office — "They tell me that the darned thing won't burn."

(*To be continued.*)

No one can deny that the study of Italian brickwork must be useful to those who are compelled, as we so often are, to use the same material in buildings for whose good architectural effect and character we are anxious. . . . We need not, in attempting to rival its beauties, confound them with faults which were essentially those of the whole Italian style. We may with the greatest advantage emulate the Italian system of brick window tracery, whilst we take care never to imitate the equally common custom in Italy of erecting sham fronts in order to display our traceries. Again, though they never used any but red bricks, there is no reason why we should not enliven our work with the contrast of other colors. — *Street.*

Fire-proofing Department.

TESTS OF FIRE-PROOF FLOORS.

THE third test of the series being made by the Department of Buildings of the city of New York to determine the resistance of fire and water of various systems of fire-proof floors was made on September 29 at the testing ground at 68th Street and Avenue A.

We give below the results of this test as furnished us by Mr. Howard Constable, under whose immediate supervision the test was made.

MR. CONSTABLE'S REPORT.

The floor tested covered a room 11 ft. by 14 ft. in the clear by 1 ft. high, with walls 12 ins. thick, of common brick set in machine-made mortar, and below the bottom of the room was constructed double grates so as to secure an intense fire.

The floor itself was made of 10 in. beams, 25 lbs. per foot, set 4 ft. apart. The filling between the beams was 10 in. flat arch blocks of porous terra-cotta, end construction, with soffit tile to protect the lower flanges of the beams, and all set in Portland cement. The ceiling was finished as usual with machine-mixed mortar and white coat ¾ in. in all, excepting that one third of the whole ceiling which was left unplastered so as to test the blocks of terra-cotta unprotected by the plastering. The top of the terra-cotta blocks was covered with a concrete of cinder and cement to the height of 1 in. above the beams, and in which were imbedded the usual 2 by 4 sleepers 18 ins. on centers ready for the wooden floor. This floor was then weighted down the middle section 4 ft. by 14 ft. with a load equal to 150 lbs. per square foot of this section, and so loaded that the weight was all on the filling and not on top of the beams. Small spaces were left under and through this load so that fires could be built on top of this floor, besides the fire applied in the room below. The fire in the room below was started at 9 A. M., and consisted of oak and hickory cord wood and ignited with a little crude oil.

9.05. White plaster commenced to peel.
9.15. Flames issuing from chimneys.
9.47. Top of floor warming up.
10.00 Wire glass in peep-hole melted.
10.25. Refiring.
11.30. 2,000 degs.
12.00. „ „
12.25. „ „
12.25. Refiring.
12.25. Brick on window jambs vitrifying.
1.18. Refiring.
2.00. 2,200 degs.
2.00. Fires on top of floor lighted.
2.25. 2,200 degs.
2.26. Re-firing.
2.50. 2,000 degs.
3.00. Water from fire engine at 60 lbs. pressure through 1⅛ in. nozzle to put on ceiling for 11½ minutes.
3.19. Top of floor flooded with water.

Measurements showed that the centers of the floor deflected with 150 lbs. per square foot before the fire —— ins.
150 „ „ „ „ during the fire 2.14 „
150 „ „ „ „ after water applied 46 ins.

Inspection after the fire showed that a number of the soffit tile and arch blocks were cracked and broken off by the intense action of the water, but that no opening had been made through the floor by the fire, or afterward by the stream of water, and that there remained great strength to the floor, as on the following day the loading was increased to 600 lbs. per square foot without breaking through, thus showing a factor of safety of over four. The work is now being done of trying if 1,200 to 1,500 lbs. per square foot will break the floor through. Inspection after the fire also showed that some of the heavy cast-iron grate bars had melted.

As the previous test to this one registered 2,250 degs., and as this furnace was slightly better built for firing, and as the same kind and proportionate amount of wood was consumed and the firing attended to by an expert from one of the greatest boiler manufacturers, and as the wire glass melted about the same time, and I had tested the metal pyrometer used, and as the bricks of the window and in peep-holes vitrified and the grate bars melted, there can be no honest doubt but that this was one of the most severe tests ever made.

I also am free to state that the floor, while a good one, was not a phenomenal one, first, because one of the best-known terra-cotta manufacturers claimed while the floor was being laid that he did not want his name connected with it, as he could furnish better material and workmanship; and second, because there have been many floors put in of the same spacing of beams and thickness of arch blocks, a partial list of which is as follows: —

TEN-INCH FLAT ARCHES USED.

115 Chambers Street, 3 ft. 5 ins., 3 ft. 10 ins. to 4 ft.

Broadway and Howard Street, average span about 4 ft. 8 ins.

Five Points Mission House, average span 4 ft. 10 ins. to 5 ft.

Johnson Building, Broad Street and Exchange Place, 4 ft. to 5 ft.

Manhattan Bank Building, 40–42 Wall Street, 3 ft. 9 ins., 4 ft. 2 ins., 4 ft. 6 ins., 4 ft. 9 ins.

Broadway and 25th Street, 3 ft. 9¾ ins., 3 ft. 11½ ins. 4 ft. 2 ins., 4 ft. 4½ ins., 4 ft. 5 ins. to 5 ft.

Fourth Avenue and 19th St., 3 ft., 3 ft. 7½ ins., 3 ft. 4½ ins., 4 ft. 6 ins. to 5 ft. 9 ins.

New York Life Building, Broadway and Leonard St., average span 4 ft.

St. Paul Building, Broadway and Ann St., 3 ft. 6 ins., 3 ft. 10 ins., 3 ft. 11 ins., 4 ft. 2 ins., 4 ft. 3 ins., 4 ft. 5 ins.

State Capitol, 3 ft. 7 ins., 4 ft.

TWELVE-INCH FLAT ARCHES USED.

Liberty Building, Liberty and West Streets, 4 ft. spans throughout.

Metropolitan Building, Broadway and Prince Street, 3 ft., 3 ft. 4 ins., 3 ft. 6 ins., 3 ft. 10 ins. to 4 ft. 10 ins.

Broadway and 12th Street, 3 ft. 3 ins., 4 ft., 4 ft. 2 ins., 4 ft. 6 ins., 4 ft. 4 ins., 4 ft. 7 ins., 4 ft. 11 ins.

37–41 East 18th Street, 3 ft. 10 ins. to 5 ft. 3 ins.

Kilpatrick Building, 67th Street, between Eighth and Ninth Avenues, 4 ft. 2½ ins., 4 ft. 4 ins., 4 ft. 4 ins.

Respectfully submitted,

HOWARD CONSTABLE.

TEST OF THE FAWCETT SYSTEM.

A similar test was made, on September 10, of the system of floor construction manufactured by the Fawcett Ventilated Fire-proof Building Company, Limited.

In this system steel beams are used a uniform distance of 2 ft. apart. Terra-cotta lintels of a hollow cross-section are supported on the lower flanges of the beams in such manner that the under side of the lintel is about 2 ins. below the beam. An air space is thereby formed between the lower flange of the beam and the base of the lintel. Above the lintel the space is filled in with concrete.

The test was made in a brick building erected for the purpose, on a lot at the corner of 68th Street and Avenue A. The building was 14 ft. by 11 ft. inside, by 10 ft. high. The roof was formed of the Fawcett floor, 6 in. beams being used, running lengthwise of the building, and the floor being designed to carry safely 150 lbs. per square foot. A small chimney was placed at each of the four corners of the roof and a grating was fixed near the bottom, covering

the whole inner area. The ceiling was made of common plaster laid directly on the bottom of the lintels, which were grooved with dovetails so as to retain it. Several cords of wood were placed on the grates, some kerosene was sprinkled on it, and the fire was lighted at 9.33 A. M. By 10.30 the pyrometer had reached 1,850 degs. Fahr., and the maximum temperature of 2,200 degs. was recorded at 10.50 A. M. At 11.10 A. M., the wood having partly burned out, the temperature had gone down to 2,000 degs. The walls of the building had by this time cracked badly from expansion of the brick on the inside. More wood was put in between 11.20 and noon, but the temperature could not be brought higher than 1,850 degs. When the maximum temperature of 2,200 degs. was reached, the roof, which had been loaded with brick on the two central panels to 150 lbs. per square foot, had sagged down about 4 ins., due apparently to expansion of the lower flange of the beams by the great heat. At 12.20 P. M. water was thrown into the building by the fire department, the stream of 60 lbs. pressure being directed against the ceiling. When the building had been cooled sufficiently to allow persons to enter it was found that the only damage done was the sagging of the beams, the removal of most of the plaster, and the breakage of the base of several of the lintels. The concrete above the lintels remained in place. On September 11 the test was continued without fire, by adding to the load on the two central panels of the roof up to 600 lbs. per square foot without any further damage being visible. During the fire test the fire did not break through the roof at any point, and the upper surface remained so cool that the hand might be placed upon it.

AN extraordinary sort of fire-proof lathing has been introduced into Germany, consisting, essentially, of little cross-shaped bits of terra-cotta strung on wires, which pass through them in two directions, at right angles with each other. One would think that such a combination would be expensive, but it is claimed to be cheaper in use than ordinary wire lathing, inasmuch as the terra-cotta crosses take the place of a large part of the plastering mortar. The mortar is said to adhere very strongly to the terra-cotta, in addition to the excellent clinch afforded by the network, and, of course, the fire-proof qualities of the material are nearly perfect. The crosses are stamped out of clay, and are, presumably, strung on the wires by machinery. It is sold in rolls one meter wide and five meters long, containing thus nearly six square yards, at three marks and a half, or eighty-four cents. This is quite as cheap as plain wire lathing, to say nothing of the saving of mortar by its use, and the application of the new lathing seems to be even easier than that of ordinary wire lathing, as it gives a good clinch when nailed directly to boarding or timbers, without furring. The German manufacturers are Herren P. Stauss & H. Ruff, Cottbus, Germany. They advertise that their foreign patents are for sale, and it would certainly be desirable to have so promising a material put into the hands of a public so much interested in fire-proof construction as that of the United States.— *American Architect.*

THE new fire-proof mercantile building for the Wyman-Partridge Company, at Minneapolis, Minn., is to be floored with brick arches instead of hollow terra-cotta, as was at first intended. The change was made to brick in order to save expense. This is the first time that this idea has been adopted in the Northwest. The brick is cemented together between I beams in arches 16 ins. high and about 10 ft. span. The beam is being secured at extremities of concave side of arch by iron stringers to prevent spreading. A section of the main floor has been subjected to a load of 650 lbs. per square foot under which there was a deflection of 1 in. only. A further test was made by dropping an 800 lb. piece of granite from a height of from 6 to 8 ft. On second drop, a few bricks at the center of arch were effected, but nothing further. This test was considered satisfactory by the architects.

Mortar and Concrete

A DEPARTMENT DEVOTED TO ADVANCED METHODS OF USING CEMENTS AND LIMES IN BUILDING CONSTRUCTION.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING. (*Continued.*)

IN February, 1895, Cecil B. Smith, Ma. E., A.M., Can. Soc. C. E., Professor of Civil Engineering, McGill University, Montreal, delivered before the Canadian Society of Civil Engineers the following exhaustive dissertation on the TESTING OF CEMENTS, which, through his courtesy and the courtesy of the society named, we are permitted to publish in full: —

CEMENT TESTING.

This subject has so often been written on, and is being so continually and persistently investigated, that it forms, as it were, an inexhaustible mine.

But this very feature shows how very important and yet how little understood it is, for when investigators continue to disagree, the presumption is that there is either a lack of agreement as to the basis on which the investigations are made, or else a failure, up to

TABLE I.—STANDARD CEMENT TESTS.

Nationality.	Date of Standard.	Authority of Standard.	Weight per Bushel or C. F.	Specific Gravity.	Chemical Analysis.	Residues or Fineness.	P. c. of Water in Mixing.	Constancy of Vol. or Blowing Test.
Canadian.	1894	Recommended by be Committee and of C.S.C.E.	Considered to be indefinite and of little value.	3.12 } for 3.25 } Portland.	Not more than 2% Sul. Acid. Not more than 5% Magnesia. Portland. Natural. Lime 0.25 Lime 34.31 Silica 10.84 Al & FeO_3 3.00 Mag. 1.60 Alkalies	Less than 5% on 50 sieve No. 35 Stubbs gauge.	Standard consistency, and rod -4" diar. 66 lbs. to nearly penetrate mortar in a box 3" diar. 1⅝" high.	24 hours in water at 120° F. and 27 days in ordinary water or Final test, 24 hours after setting in boiling water.
English.	1893	Standard Practise no Regulations.	About 112 lbs. per bushel for Portland.	Not less than 3.10 for fresh or 3.07 for 3 months old (dried 15 minutes).	Recommended to be made.	5% on 80 sieve 12% on 100 " 32% on 180 " 37% on 200 " wire mesh.	Approximately 25% of water. Neat 12% 3 to 1, 14% 3 to 1 sand, Faija mixer.	Same as above, of which this is the original.
United States.	1885	Recommended by A. S. C. E. generally used and adopted.	(Authority of Clark.) French Port 60 per C.F., English Port 78 to 87, per C.F., American Port 93 per C.F.	Not specified.	ditto	5 to 10% on 50 sieve down to 3 to 10% on 176 sieve.	Approximately 25% mortar. Neat Port., 20% Natural, 15% 1 to 1, 12% 3 to 1 stiff mortar.	1 pat in air 1 month for signs of discoloring, 1 pat in air till set, then 1 month in water for checking. 23 hours in air, 1 hour boiling, or 28 days in water.
German.	1893	Government Regulations.	370 lbs. per barrel net.	3.12 } for 3.25 } Portlands, increase with age.	ditto	10% on 76 sieve wire mesh.	Same as the above, which is a copy of this one.	Same as the above, which is a copy of this one.
French.	1884 or later.	Government Regulations.	1 litre to weigh within 3½ ozs. of heaviest cement from same factory, all sifted through No. 100 sieve.		Not more than 1% Sul. Acid. Not more than 4% $Fe\,O_3$. When Si. and Al. are less than 44% of lime.	None specified, argued that fine grinding gives high strength in periods of tests chiefly, which disappeared later on.	Sea water, standard consistency round ball dropped after 20' on slab to retain its general form without cracks.	Put in sea water (¼) days, no cracking or bulging.
Austrian.								

the present, to solve all the intricate mazes of the problem, or indeed a combination of the two.

To illustrate the first point, a tabular synopsis (Table I.) is presented, giving the present standard tests in use, in various countries, according to the latest obtainable information. The variations, in many cases, are too great to be reconciled, in others trifling; but it is evidently difficult to compare results obtained in different countries, and a hopeless task to ever bring them to a uniform standard. What it behooves us, as Canadian engineers, to do is to take such sensible and immediate action on the subject as will commend itself to the good graces of all of us, if possible, or, if not, of a great majority of those who test the manufactured article.

However, before proposing a mode of conducting such tests as will (according to the author's experience) be of practical utility to practical men, the following Table (Table II.) is presented to the Society as embodying results which have been obtained during the last two sessions, in making ordinary commercial, private, and student tests (chiefly commercial and private).

Many results have been discarded as being inaccurate, and only those are recorded here which are believed to be very close to the truth, much closer than is ordinarily obtained.

These results have been classified according to country of manufacture, and somewhat on a scale of increasing tensile strength.

Let us consider the various qualities given in their tabular order.

(*a*) *Specific Gravity.*

The average of Canadian Portlands = 3.11.

The average of English Portlands = 3.10.

The average of Belgian Portlands = 3.055.

The average of all Portlands (16) = 3.09.

It would seem advisable, therefore, to specify a minimum for Portlands of 3.10.

The samples were not dried or prepared in any way; if they were dried for fifteen minutes, according to English practise, it is probable they would go somewhat higher.

It will be noticed that the only two Portlands (?) whose specific gravities were low (Belgians Nos. 16 and 17) were both poor cements. One, No. 16, sets slowly, and the briquettes made for 4 week tests, and immersed in water after 24 hours were found sloughed down in the tanks, and had evidently run and set over again! They would not give any test to speak of. Evidently the hydraulic property, in 24 hours, was not enough to hold them together, while the other one (No. 17) failed in the blowing test. Altogether, it is doubtful whether these cements are Portlands or naturals, although sold as the former, owing to their color being gray.

It will be noticed, with satisfaction, that Canadian Portlands stand at the top in specific gravity, judging by the samples tested, which were, however, all received from manufacturers.

The specific gravity of natural cements might be placed at 2.95, although it is not so likely to be under-run, owing to the ease with which this can be obtained.

(*b*) *Water required for standard consistency.*

This is considered by many to be very important; but many tests have demonstrated to the writer that what is especially needed is that there shall be sufficient to make good briquettes; to err, say, 1 per cent. in adding water is fatal if too little, while if too much, it does not seem to affect the strength of briquettes at 1 week, certainly not at 4 weeks. This is contrary to statements often made regarding

Setting Quality.			Tensile Strength.			Compressive Strength.								
Neat.	How defined.	How determined.	Neat.	1 to 1.	3 to 1.	Neat.	1 to 1.	3 to 1.	Kind of sand used.	How put in Molds.	Rate of loading in tensile tests.	Time in air before immersions.	No. of tests used for Averages.	Time of Mixing.	Wearing Qualities.	Adhesive Qualities.
			Not yet year later.		specified, to be	reported on 1			Standard crushed quartz to all pass No. 20 sieve all caught on No. 30 sieve.	10 lbs. per square inch steady pressure.	200 lbs. per minute.	24 hours.	Not stated, probably 5	1 minute for quick setting, 2 minutes for slow setting, mechanical mixer.		Mr. Mann. 1 week 57 / 1 month 79 / 3 months 98 / Fineness has great effect.
									ditto.	10 lbs. on briquette for 5 minutes, or shaken in molds or beaten with trowel for 1 minute.	400 lbs. per minute.	24 hours.	5	1 minute or more, mechanical mixer.		
									ditto.	Pressed in with trowel without ramming.	ditto.	24 hours.	5 Smallest section only.	1 minute or more, hand or mechanical mixing.		
									Standard crushed quartz, ½ to pass 20, caught on 30. ½ to pass 30, caught on 36 sieves.	Bohmes' apparatus, 150 blows with trip hammer weighing 4·4 lbs.	13 lbs. per minute.	24 hours.	10	½ minute for quick setting, 3 minutes for slow setting cements.	1 to 1 and 2 to 1 than neat or 3 to 1 tough at 7 days at 20 days.	Advised to be still reported on and investigated, at 7 days as to be made on ground glass.
1 week 300-400 1 month 480-630		3 days 110 1 week 120-220 1 month 200-350							Crushed Cherbourg quartz pass No. 20 caught on No. 30 sieves.	Filled in and tamped with rammer weighing 7 ozs. till water stands on surface.	Not specified.	24 hours then in sea water of 59° to 64° F.	Mean of 3 highest taken.	5 minutes by hand on a slab, temperature of air 59° to 64° F.		
Natural 1 day 40-80 1 week 60-100 1 month 100-150 1 year 300-400 Portland 1 day 100-140 1 week 250-550 1 month 150-700 1 year 450-800		Natural 1 week 30-50 1 month 50-80 1 year 200-300 Portland 1 week 80-125 1 month 150-200 1 year 200-350											10 Mean of 6 highest taken.			
Minimum. 1 week 285 1 month 498 3 months 640; to show 25% increase 1 week to 1 month.		Minimum. 1 week 114 1 month 213 3 months 266														
					1 month 227½			1 month 2275								
					1 week 114 1 month 171											

the increased strength given by a minimum amount of water; but probably what is referred to is an excess of water sufficient to make a thin batter or soup. Undoubtedly, such an amount not only makes the briquettes shrink and crack in drying, but will seriously affect the early strength.

A very peculiar effect was met with in two Canadian and one English Portlands. They were evidently fresh, and when mixed with a normal amount of water would work into a good plastic mass, but in about one or two minutes after the water was added, they would suddenly set so hard that it was useless to attempt to put them in the molds.

By increasing the per cent. of water to about thirty, a thin batter was made, which could be got into the molds before this action took place; of course this amount of water made the set very slow, and deadened the indurating action in 1 week tests.

When tests were made, several weeks later, on these cements, this effect had disappeared; perhaps some one connected with the industry can explain the cause of this action.

(*c*) *Residues or Fineness.*

The variation is enormous, as the following statement shows: —

Residue on No. 50 Sieve. Per Cent.	Residue on No. 80 Sieve. Per Cent.	Residue on No. 120 Sieve. Per Cent.
Coarsest 31.4	52.2	61.2
Finest 0.25	2.7	6.7

The English Portlands are generally very coarse, as will be seen, and the selected Canadian ones fine.

It is not putting it too severely to say that specifying a certain residue on No. 50 sieve is a direct premium on coarse grinding, and so, in fact, are neat tensile tests.

For instance, English brands, Nos. 10, 11, 12, 13, and Nos. 14 A, 14 B, are all evidently ground to pass a specification of 5 per cent. residue on No. 50 sieve, and are all very coarse when sifted on finer ones, thus plainly showing the failure of the specification to obtain as good a product as possible.

The author would urge the severest requirements for fineness.

Various papers read and the statements of manufacturers themselves go to show that the increased cost is very slight, not more than ten cents per barrel between ordinary and fine grinding,

10 per cent. residue on No. 80 sieve
20 per cent. residue on No. 120 sieve } as maximums are not too

high for present facilities for fine grinding; this would let in three out of four Canadian Portlands tested, one out of ten English Portlands tested, two out of four Belgian Portlands tested, or in all six out of eighteen brands. There are signs, however, that the English manufacturers are waking up to finer grinding, and will soon fall into line; there is no reason why educating influences should not bring grinding down much finer still for ordinary brands, but for the present, too much severity would defeat the object in view. (For tests on the effect of fine grinding, see Series I. of Experiments.)

(*d*) The time of incipient and final set, as found by Gilmore's needles, does not seem to affect the strength, except for very short tests. When the slow settings are generally stronger, good cements may be either the one or the other; but ordinarily, unless for tidal work, a slow setting one has the desirable feature of allowing masons

TABLE II.

CONDENSED TABLE OF CEMENT TESTS. 1893–1894.

Designation of Origin.	No. in Table.	Obtained from.	Specific Gravity.	Per cent. water for standard consistency.	Residue per cent. on Sieves No. 20.	No. 50.	No. 80.	No. 120.	Blowing test result.	Time of setting in air. Incipient.	Full.	Average Tensile Strength in pounds per square inch. Neat Cement. 8 days.	1 wk.	2 wks.	4 wks.	2 mos.	3 mos.	4 mos.	6 mos.	1 yr.
Canadian No 1	1	Dealer	3.01	33	0	7.2	12.5	18.3	very good	4'00"	7'45"	78	71	...	...	226	...	478	492	...
Canadian No 2	2	Maker	3.06	33½	0	2.0	11.2	21.4	good	0'45"	2'45"	99	150	...	124	277	448	...	...	...
Canadian P 3	3	Maker	3.12	25	0	1.1	14.2	31.2	good	5'00"	20'00"	125	210	...	350	...	...	...	...	...
Canadian P 4	4	Maker	3.12	25	0	0.8	2.7	6.7	good	0'32"	3'10"	335	338	...	525	...	...	...	...	...
Canadian P 5	5	Maker	3.09	25	0	0.6	5.5	13.2	good	1'00"	5'00"	275	399	...	459	...	...	...	...	...
Canadian P 6	6	Maker	3.12	24	0	0.9	6.4	13.2	good	4'30"	6'00"	438	588	...	671	...	...	...	...	...
Canadian P 6d	6d	Dealer	...	24	0	3.0	13.6	26.7	very good	2'00"	6'30"	312	331	...	611	...	...	...	...	...
Canadian P 6f	6f	Dealer	...	24	0	2.3	27.0	40.7	fair	...	...	390	307	...	...	...	...	...	...	...
Canadian P 6c	6c	Dealer	...	23	0	31.4	52.2	61.2	bad	...	...	583	284	...	331	...	...	...	...	...
English P 7	7	Dealer	...	13	0	10.5	21.6	...	good	3'20"	6'30"	160	310	...	538	...	...	...	...	...
English P 8	8	Dealer	3.09	25	0	14.0	39.5	...	good	15"	2'00"	390	414	...	581	...	...	...	...	...
English P 9	9	Dealer	3.09	26	0	1.4	12.8	22.9	good	15"	2'00"	390	386	372	533	...	...	...	...	...
English P 10	10	Dealer	3.10	23½	0	6.7	19.4	26.5	good	35"	1'00"	336	477	396	504	560	637	697	644	...
English P 11	11	Dealer	3.08	23	0	4.0	19.2	28.1	good	21"	3'00"	244	362	...	547	...	...	...	...	...
English P 12	12	Dealer	3.11	24½	0	4.8	17.5	26.3	bad	20"	4'00"	335	344	...	422	...	...	...	...	...
English P 13	13	Dealer	3.13	24½	0	0.25	5.0	12.9	very good	20"	2'30"	...	387	444	495	...	...	...	...	...
English P 14	14	Dealer	3.13	23	0	5.6	20.9	30.5	bad	27"	3'05"	...	343	350	469	...	...	...	...	...
English P 14b	14b	Dealer	3.05	23	0	5.3	19.7	30.1	some bad	20"	2'30"	304	309	...	440	...	...	...	...	...
Belgian No 15	15	Dealer	2.97	30	0	7.7	15.4	19.4	very good	1'00"	2'30"	154	310	...	285	...	...	...	...	...
Belgian P 16	16	Dealer	3.03	26½	0	2.1	12.9	20.6	good	5'00"	12'00"	232	332	...	F'd	...	...	...	...	...
Belgian P 17	17	Dealer	3.09	26	0	3.1	12.9	20.1	bad	1'10"	5'00"	328	394	...	487	...	...	...	...	...
Belgian P 18	18	Dealer	3.09	27	0	0.1	2.8	9.4	good	1'20"	4'30"	255	300	...	492	...	...	...	...	...
Belgian P 19	19	Agent	3.08	25	0	0.9	6.2	15.8	good	2'40"	7'40"	452	536	...	535	...	...	...	...	...
	20		...	25	...	...	...	...	...	...	...	...	...	463	...	...	...	...	...	533
	21		...	25	0	4.0	10.8	...	...	...	...	...	152	495	545	...	...	...	...	648
	22		...	...	...	...	...	...	...	...	...	...	345	450	...	...	...	...	...	606
	23		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	593
Total.....			...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

AVERAGE TENSILE STRENGTH IN POUNDS PER SQUARE INCH.

	1 to 1.				1½-2 to 1.	2 to 1.					3 to 1.									
	1 wk.	2 wks.	4 wks.	3 mos.	6 mos.	1 month.	1 wk.	4 wks.	2 mos.	3 mos.	4 mos.	6 mos.	1 wk.	2 wks.	4 wks.	2 mos.	3 mos.	4 mos.	6 mos.
	68	...	102	162	165	132	...	...	...	...	...	...	30	...	72	...	...	...	...
	76	...	115	162	...	...	...	...	...	...	...	...	49	...	75	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	43	...	92	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	106	...	126	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	232	345	316	253	257	531	...	198	189	196	189	271	58	79	102	...	...	...	...
	192	...	204	245	...	...	...	...	...	...	...	...	77	64	90	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	34	...	...	...	...	...	...
	134	...	195	...	...	...	48	77	...	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	133	...	154	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

to mix and use good-sized batches of mortar, without constant tempering, which is the practise with quick-setting ones, much to their own hurt.

(*e*) The blowing test advised by Faija has detected a "blowey" tendency in several instances; but much late evidence seems to throw some discredit on blowing tests, whether made with hot or boiling water, on the ground that manufacturers can, by the addition of sulphate of lime, cause the cement to be so slow setting and set so strongly as to resist the blowing tendency of so much as 3 per cent. of free lime added after the cement had been burnt. If this is a fact, chemical analysis will need to be resorted to more frequently, to detect this dangerous adulteration, which is fatal in sea-water and bad in any case, as the great strength which it gives to cements at early dates is apt to decrease at longer periods. Belgian No. 19 cement tested gave higher results at 1 week than at 4 weeks; this looks a little suspicious.

Cements have been tested usually neat; the Germans have reached the stage of three to one mixtures as the deciding test, and this would seem to be the only rational way of testing a cement, *i. e.*, in the same condition as it is used.

The difficulty, however — and it is a very serious one — has been to get anything like uniform results in sand tests. The variation in putting the mortar in the molds has been so much more than the variation in the cementing value of the cement that the tests were valueless, so that most testers have clung to neat tests as being simple and a fair index of cementing qualities. That this view is in fault and misleading, every tester will admit, and it is only partly avoiding the difficulty to specify a certain fineness, strength, and specific gravity in combination, and even then the results are not definite, as each cement is different in value. However, for those who have facilities for testing cement neat only, — and these will probably be in the majority for some time to come, — it would seem that 350 lbs. at 1 week neat and 450 lbs. at 4 weeks neat are easily obtained, and quite enough to specify. Eleven brands tested would give this much strength and stand the blowing test, and of these there are six brands fine enough for 10 per cent. residue on 80 sieve and 20 per cent. residue on 120 sieve, with a specific gravity varying from 308 to 313, while the six brands which are not strong enough are also too coarse.

The tests on natural cements are not extensive enough to form a good basis, but it would seem easy to get 100 lbs. neat at 1 week and 200 lbs. neat at 4 weeks, and a fineness the same as for Portlands.

The tests on No. 2 natural and No. 11 Portland were carried on for 6 months, and show the natural to be gaining on the Portland, although each has evidently nearly reached a maximum. This would seem to bear out the idea which many people yet have, that, in time, a natural cement, not being so brittle, will catch up to a Portland. Long time tests are very much needed on this subject.

Natural cements being underburnt (usually) have very much less combining power with sand; the one to one natural is not as strong as two to one Portland, according to tests made last year as per Table II. in which the mixtures were made with 15 per cent. of water for one to one, and 12 per cent. of water for three to one mixtures, the mortars being lightly tamped into the mold with an iron rammer; the tests made this year, however, by means of a uniform pressure, give much higher results for one to one naturals, when 20 per cent. of water is used, which would seem to be nearer to the amount used in practise, making a soft plastic mortar. (See pressure tests.)

Natural cement has many uses. It is being passed aside in many quarters. Why? because *if immersed in water* for 1 week or 4 weeks, it will give low tensile tests. That terror of the present day, the testing machine, condemns it.

(*To be continued.*)

No. of Tests.	Trans.	Comp.	Tensile.	Transverse Strength. Neat 1" x 1" broken on 6" centers. 1 wk	2 wks.	3 wks.	4 wks.	1 year.	Average Compressive Strength pounds per square inch. Neat Cement. 1 wk.	2 wks.	3 wks.	4 wks.	3 mos.	1 year.	1 to 1. 1 wk.	4 wks.	2 mos.	2 to 1. 1 wk.	4 wks.	2 mos.	3 to 1. 1 wk.	wks.
1	0	1	27										1600		920	1350						
2	0	8	100						1285			2255										
3	0	3	33																			
4	0	4	33																		205	4·5
5	0	1	30																		39½	412
6	0	3	35				43		1565			2493	4975		920	1350						10·5
7	0	0	15						3025													
8	0	0	0																			
9	0	0	10																			
10	2	5	10				84		1502			1720										
11	3	0	30				99		1967			2650	4500									
12	0	1	40																			
13	0	0	29																			
14	2	0	105				112										3325			800		
15	0	0	44														2820			3200		
16	0	0	14																			
17	0	0	30																			
18	0	0	30																			
19	0	0	93																			
20	0	0	35						1850			1930						743	953			
21	0	0	10																			
22	0	0	13																			
23	0	0	30																			
24	0	0	24						2970			4180									718	900
25	3	0	12					113						6911				12	17			
26	3	0	17				86							4326				17	13			
27	3	0	13				59							9066				13	6			
28	3	0	8					(60?)										8				
29	—	—	6															6				
83	19		894																			

The sand briquettes were lightly tamped with a small iron rammer.—*C. B. S.*

LIME AND MORTAR.

IN country places where lime has to be hauled a long distance, proper provision should be made for its preservation when it arrives at the works. In a damp atmosphere a cartage of ten or twelve miles may cause a load of lime to be partly slaked before it reaches its destination, and in cases of that kind, it would be better, when possible, to run it in the bed at once and finish the slaking; then nearly the full virtue of the lime may be captured. When this cannot be done the lime should be put in a dry place, and used as soon as possible. Lime should never be stored in a cellar, or in any place where it is damp, as it will lose half its virtue in a very short time in such a place, and the mortar made with it will never give satisfaction. Good live sand is a necessary requisite for making good mortar, and the contractor should see to it that such is furnished to the plasterer. Dead sand, while easy to work, never makes a good job, and mortar made with it soon rots and crumbles away from the wall. It is the silica in the sand that combines with the lime, that forms the hard, solid mortar we find on some of our old houses. Good long hair, that has been washed, should be used in the mortar in proper proportions to insure good work. Plasterers, as a rule, stint the hair in their mortar as a matter of economy, but this is wrong, and in a measure dishonest. To insure good and lasting work, the mortar should not be used until it has been made at least ten days. It will be better to stand fourteen days if conditions will permit. The best results in plaster work are obtained with well-made mortar that has been made one month or more before being used.— *Canadian Architect.*

The Masons' Department.

CONDUCTED IN THE INTERESTS OF THE MASON AND THE CONTRACTOR FOR BRICKWORK.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

NOTHING shows more plainly the change which has taken place in the methods employed in the building business than the relative importance which is now attached to a building contract, compared with the way such a document was regarded only a short time ago. It is not many years since quite extensive building operations were carried on without any formal written contract, and when one was executed contractors often went so far as to leave their copy in the hands of the owner or architect, saying or inferring that such a document was entirely unnecessary. With more active competition, however, and the gradual but steady reduction in the margin of profit, the builders began to realize that their business, in order to be carried on with success and pecuniary gain, must be conducted under well-defined conditions, and these conditions must assure for them equal rights with those of the owner. One of the first things to receive attention was naturally that of payments. Until recently, that is to say, so long as building operations involved no large amounts of money, payments on account were usually made in lump sums at stated intervals unless, as was often the case, this entire matter was left in the hands of the architect. But now that it is by no means uncommon for a building contract to involve hundreds of thousands of dollars, the builder finds that his payments on account must be made with regularity, and must also somewhere nearly equal the amount which has been expended for labor and materials up to the time the payment is made. This demand on the part of the contractors has led to the system, now quite universally adopted on all work of importance, of making monthly payments equal to a certain per cent. of the amount expended, the balance being held until the completion of the work. When this system was first adopted it was usually customary to pay on account seventy-five per cent. of the value of work done and materials furnished; but there has been a constant tendency to increase this percentage, and at the present time eighty per cent. is the usual proportion, although often eighty-five, and sometimes ninety per cent. is paid. The method which has been employed to a considerable extent in the past of making payments dependent on the completion of certain stated portions of the work (as, for example, so much when the foundation is in, so much when the roof is on, etc.,) is now seldom used except on comparatively small contracts, such as country houses. The result which this method sought to accomplish, namely, that of making an incentive for the prosecution of the work with all reasonable diligence and dispatch, is accomplished now by other means. Another matter practically a part of the question of payments, which has received the consideration of the contractors, is the amount that it is just and proper to retain after the completion of the work in order to secure the owner against liens or such imperfect work or materials as time alone can develop. The retention of from fifteen to twenty-five per cent. of the amount of a contract, especially if it be a large one, for an indefinite period is often a serious matter for the contractor. The difficulty of final settlement is, moreover, further complicated from the fact that it is practically impossible to determine the exact time at which a building may be said to be completed. And there are often certain things of minor importance at the end of a piece of work which the general contractor is prevented from finishing on account of delay or default on the part of the owner or architect. It seems hardly fair in cases of this kind, which are of frequent occurrence, that the contractor should be kept from receiving the greater part of the final payment to which he is usually justly entitled. But it often happens that the contractor has to wait an unreasonable length of time for his settlement, on account of some whim of the architect or the desire of the owner to save interest. What seems to be a fair and satisfactory solution of this difficulty is suggested by the English practise, where the contractor receives all but a small percentage of his final account thirty or thirty-one days, as the case may be, after the completion of the work, and the amount retained after this payment, usually about five per cent., is held from six months to a year longer as an assurance that any minor defects which may develop in that time will be made good. This method, while it inflicts no financial hardship on the contractor, assures the owner that such matters as leaky roofs, defective joints in plumbing, uncalled for shrinking or swelling of finish, and the like, will be promptly and properly attended to. As things are now, it is seldom possible, after the final payment has been made, to get the contractor to pay any attention to such defects, and as a result of this the various guarantees which appear in the specification are of little or no practical value. Besides the all-important matter of payments there are many other features of a building contract which are of consequence to the contractor. Until within a few years each architect used his own form, and, of course, no two were alike. Under these conditions a builder seldom knew the requirements under which he would be expected to execute a piece of work if the contract should be awarded to him, and in many instances he thoughtlessly signed a document, the provisions of which turned out to be manifestly unfair. It was to secure a regularity of practise in this respect that a joint committee of the American Institute of Architects and the National Association of Builders, after considerable labor, agreed upon a form now known as the Uniform Contract, which both associations recommend for general use to their members. While this form of contract is admirable in most respects, it bears in some degree the marks of compromise, and is, of course, unfitted for large public work or work which is to be executed under peculiar conditions; but in spite of minor defects, it is a form which can be used to advantage in all ordinary cases, and its use has now become quite general among the best practitioners. The strongest argument used by builders in favor of the adoption of the Uniform Contract, namely, that when a contractor signs this form of contract he knows exactly what it means, is not as strong as it first appears, for this reason: Attention has been already called to the fact that the specifications are virtually a part of the contract, and it is consequently a simple matter in the general conditions to extend or supplement the provisions of the contract so as to make the conditions under which the work is to be executed just as unfair or unjust to the builder as if the objectionable paragraphs were contained in the contract itself. And in point of fact, if the owner or architect is inclined to indulge in sharp practise, the place where he will naturally put his objectionable requirements is not in the contract, where they will be practically sure to be seen and questioned, but in the general conditions, which, as has been already stated, are seldom read, and still more rarely considered, and are, furthermore, apt to be entirely forgotten at the time the contract is signed, which serves to emphasize the importance of a complete understanding on the part of the contractor of this portion of the specifications. The production of the Uniform Contract is an important step in the right direction, but the joint committee should go farther and frame a uniform set of general conditions, leaving the purely descriptive part of the specifications to be written as occasion demands. And, furthermore, if this suggestion can be carried out, it will tend to simplify matters, as now many provisions are duplicated, being both in the general conditions and the contract, and often the requirements of these two portions of the agreement are contradictory.

It may be of interest to note that "A Form of Agreement and Schedule of Conditions for Building Contracts," issued by the Royal Institute of British Architects, seems to be compiled on the plan suggested above. What are called the "Articles of Agreement" occupy the first page and contain first, the date, the owners' and contractors' names, and the identification of the drawings and specification; then

follows the amount of the consideration which it is stipulated shall be paid under the conditions which follow; then comes the identification of the architect, and lastly the provision that "the said conditions shall be read and construed as forming part of this agreement, and the parties hereto will respectfully abide by and submit themselves to the conditions and stipulations, and perform the agreements on their parts respectfully in such contained." This agreement, which contains only five paragraphs, the parties sign. The following pages contain thirty-two paragraphs, entitled "Schedule of Conditions," which appear to comprise what might be called the subject matter of our ordinary building contract and the general conditions of the specification combined in one document. The adoption of some such form as this would tend to still further simplify the relations between architects which the adoption of the Uniform Contract has already accomplished to a considerable extent.

(*To be continued.*)

THE INDIVIDUAL RESPONSIBILITY OF THE CONTRACTOR. II.

BY D. B. GARNSEY.

THE average contractor in the building trades complains bitterly of the conditions to which he is obliged to submit in order to obtain work. He considers the manner in which he is required to estimate upon and compete for work to be damaging and one-sided. If he is a general contractor, he objects, for example, to being required to assume sub-contracts without extra compensation; if he is a sub-contractor, he objects to being "placed" with a general contractor, and thereby made dependent upon the latter for his money; and both believe that they are required by custom to contend against numberless practises that operate to obstruct the transaction of business and to restrict or extinguish legitimate profit.

Contractors have so long accepted the conditions of which they complain as being inevitable, that they believe they are compelled to secure their profit within the operation of the conditions complained of, and it is rare indeed that their complaints and objections are ever heard by the persons to whom they should properly be made. The average contractor believes his position as an individual to be so weak that he dare not demand those conditions which he deems equitable; for, arguing from his own methods, he is certain that, should he decline to accept the conditions under which alone a contract would be awarded, there are many others who would not hesitate at the conditions to which he objects.

Believing himself helpless, therefore, he submits without protest to the conditions to which he secretly (so far as the other party to the contract is concerned) objects, and seeks to conduct the work by such means as will insure a profit, but convinced at the outset that he is submitting to unfair requirements. There is another sort of contractor frequently to be met with: the man who has been bred to the business under existing customs, and who is so imbued with the spirit by which they are permeated that he does not know when conditions are equitable and when they are not; and who deems unfair only such requirements as seem to prohibit profit under the methods and practises to which he is accustomed.

However well informed privately an owner may be of the exactions required of the contractor, he is seldom brought face to face with the contractor's side of the question; and it is but natural for him to assume that if the contractor is contented with the situation, he (the owner) is not under obligation to point out those conditions by which the cost of the building is reduced at the contractor's expense. The owner generally accepts the opinion of his architect as to the requirements of competition and contract, and the architect, anxious to produce a building for his client as cheaply as possible, discounts his knowledge that a contractor can be readily found who will perform the work under any conditions however damaging, and exacts such requirements as he sees fit.

The fact that the building business is daily conducted under conditions entailed by improperly conceived and imperfectly sustained relationships existing between contractor, owner, and architect is no reason why it should continue to be conducted under such conditions. It would be idle to attempt to lay down a hard and fast course of procedure for the elimination of the conditions complained of, with the expectation that even if they were perfect they would be adopted, or that even the value of that adoption would be understood. The cupidity of the individual prevents concerted action by the mass; and the diversity of men's minds prevents concerted action by even a sufficient majority to dislodge from their foothold injurious conditions that are the result of years of acquiescence. It is only by steadily instilling into men's minds a knowledge of their own responsibility for the conditions of which they complain, until that knowledge shall have become sufficiently full to beget action, that inequitable customs may be transformed and the business conducted upon an approximately just and profitable basis. The average contractor must be made to understand that, no matter who was responsible for the birth of the customs to which he objects, he, and he alone, is responsible for their perpetuation. He must be made to say, with conviction of its truth: "If I submit to the requirements of this competition or this contract, I admit their justice, and have no cause of complaint; and by my action I advertise to those with whom I have business dealings that I will give away at least a part of my rights in order to secure work."

As it is a fact that there are certain contractors who decline to submit to unfair requirements and still are able to conduct their business profitably, so it may become a fact that those inequalities existing in the building business may be steadily reduced until they reach the minimum; but that minimum will never be reached so long as the contractor does all his complaining and protesting where it will produce not the smallest result. Unjust requirements must be pointed out to those who seek to exact them, whether owner, architect, general or subcontractor, and the protest should be a manful, business-like statement of fact. Persistent effort alone will produce results, and it is self-evident that customs which are the outgrowth of years of neglect cannot be wiped out in a day, or by the breath of purposeless and ill-directed "kicking."

The contractor is one party to a relationship that should be just; and when he yields some part of the profits which should accrue to him from that relationship, he confers upon the other party an excess of profit to which he is not entitled. Long-standing custom, the *present* competitive system (?), and the contractor virtually constitute a conspiracy to defraud the contractor for the benefit of his patron. That many contractors attain financial success has no bearing upon the fact that, however equitable the competitive system may be in theory, in practise the system is so badly administered that the contractor suffers under its operation, and for that suffering is largely, if not solely, to be blamed. Being the seller in a competitive market, he undersells himself.

WHAT IS THE PROPER METHOD OF CONSTRUCTING A BRICK CISTERN?

EDITOR THE BRICKBUILDER.

Dear Sir: — Will you or some of your correspondents having knowledge of the subject give me information as to the best method of constructing a brick cistern, 12 ft. in diameter and 12 ft. deep, the bottom to rest on sandy soil? I find expert opinions differ as to the thickness of the walls, the proportion of cement to be used, and especially as to whether the foundation would better be constructed of three courses of brick, with an inverted arch for the bottom, or flat, with 12 ins. of good concrete, two parts cement, one part sand, and four parts clean broken stone. Opinions seem to agree that the vertical walls should be at least 12 ins. thick.

Yours truly,

46 Cedar St., New York City. F. C. MOORE.

[We should be glad to hear from any of our readers who have a theoretical or practical knowledge on this subject. — ED.]

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

CHICAGO. — Architects say that all work on their boards is stopped awaiting the election; and that really is the status of affairs here.

By referring to the files of THE BRICKBUILDER, a record can be found of the time of beginning two projects: one, the new post-office for the government; the other, the new Illinois Trust and Savings Bank Building. The former had the start, but before the roof of the old post-office was completely torn off and razing of walls was begun, the old Grand Pacific Hotel had disappeared, new foundations went in, walls appeared, and now steel work for the first floor is in place. While the government officials were talking about letting a contract to remove the old post-office building, plans were being made for a large hospital. The latter (Alexian Brothers' Hospital) is now up three stories, and has just been the object of a notable ceremony by twenty-five thousand Catholics. It will be interesting to see how long these two important buildings will be occupied before the government building is fairly started.

TERRA-COTTA BRACKET, MABLEY BUILDING, DETROIT.
D. H. Burnham & Co., Architects. Made by Northwestern Terra-Cotta Company.

Another institution lately dedicated to public use is the Lewis Institute, which, like Armour Institute, is destined to become a great technical and manual training school.

Of buildings now approaching completion, of particular interest to brick and terra-cotta lovers, one is the Trude Building, illustrated in the last issue of this journal. The entire exterior is of a pleasing yellow-colored brick and terra-cotta. In striking contrast with the Trude in the matter of color and design is the new Silversmiths' Building, drawings of which I hope soon to send for illustration. It has a rich mottled, dark-green, glazed terra-cotta for the lower stories, with red brick and terra-cotta above.

One of the first buildings designed by H. H. Richardson in Chicago was the Monroe Street office building of the American Express Company. The mansard roof has recently been changed under the direction of Jenney & Mundie into some additional stories. Another building of importance to be altered is the Royal Insurance. The same architects are working on the drawings, which provide three additional stories.

Holebird & Roche have planned an elaborate entrance for Graceland Cemetery. The material used will be granite.

W. A. Otis has made plans for a church at Woodlawn and 57th Street.

The Chicago Architectural Club has just elected for its president, Mr. Richard E. Schmidt, who designed the Alexian Hospital mentioned above. Mr. George R. Deane, the retiring president, is serving as an instructor in the architectural department of the Art Institute this year. The club is in a prosperous condition considering the times, and looks forward to a prosperous year.

ST. LOUIS. — Energy and persistent determination have removed almost all evidence of the tornado of last May, save that found in the parks and streets, where the trees were destroyed,

MADE BY THE NEW JERSEY TERRA-COTTA COMPANY, FOR OFFICE BUILDING, 585 BROADWAY, NEW YORK.
Cleverdon & Putzel, Architects.

and the results have far exceeded anything thought possible by even the most vivid dreamer who may have visited the scenes of destruction on the following morning.

Around Lafayette Park, the most aristocratic neighborhood on the south side, and where one would naturally expect a return to natural conditions sooner than elsewhere, the least progress has been made toward rebuilding; although it is believed that even here, in a very short time, there will be little left to remind us of the great disaster. Several of the churches have been rebuilt. The Union Club is rebuilding, and a movement is on foot to rebuild Anchor Hall.

Even though the loss of property and life was great, we cannot say that there have been no good results, for, besides the benefits that have accrued to the workingman by creating a demand for his labor that would not have occurred otherwise, the owners have, in many instances, put up new buildings, better arranged, provided with more modern sanitary appliances, and having less offensive exteriors.

There has also been a general awakening of the spirit of progress among the south side people, and new enterprises are springing up on all sides.

The Drummond Tobacco Company recently completed a 100 ft. six-story addition to their factory, besides adding an additional story to the entire old building, which adds very materially to its appearance. Usually, the adding of another story to a building adds nothing to its

TERRA-COTTA BRACKET, MABLEY BUILDING, DETROIT.
D. H. Burnham & Co., Architects. Made by Northwestern Terra-Cotta Company.

RIGHT AND LEFT SPANDRELS FOR THE NEW THEATER 142D STREET AND THIRD AVE., NEW YORK.
J. B. McElfatrick & Son, Architects. Executed in Terra-Cotta by the Excelsior Terra-Cotta Company.

architectural appearance, but in this case the extending of the old piers through the upper story and crowning them with caps and a neat brick cornice has produced very desirable results.

The Louisville & Nashville Railroad has for some years taken especial interest in the shipping of fruits and produce, and passing through the great fruit-producing fields of the South and its connection with New Orleans and Mobile has given it an advantage over many of its competitors.

In order to handle the freight quickly and get it into the hands of the produce men at a minimum cost, it has expended $475,000 in building a produce exchange. The building is located at the Louisville & Nashville yards, and has a frontage of 400 ft. on Broadway, with a like amount along the railroad, and 100 ft. along Cass Avenue. Along the rear is a wide platform, and this, together with the entire sidewalk in front, is covered with a glass roof supported on iron cantilever trusses. The buildings have electric elevators, etc., and arranged so that freight can be transferred directly to or from the cars to the building.

Business continues dull with little encouragement for any fall or winter work, although every one is hopeful that there will be something more to do after the election.

PHILADELPHIA. — As in other cities, the building situation is exceedingly dull, with a prospect of quite a rush immediately after the fall elections have instilled confidence into financial circles; there are a number of projects, both public and private, which are to go on at once to completion if confidence will again be restored; meanwhile, the few large buildings which have been in course of construction for a few months past are being pushed to completion.

The buildings of the Girard Estate, the S. S. White Dental Manufacturing Company, Baptist Publication Society, Thackara Building, etc., are being hastened forward, while several which were intended to be built upon the square surrounding the City Hall have apparently been abandoned.

The steel frame for the Girard Building is worthy of note. It is made by the Pencoyd Company, and the very substantial appearance of it is in marked contrast with some of the others which have gone up under our eyes in the last few years; it appears that the dangers of vibration and wind strains, which were formerly thought very lightly of, are being seriously considered by architects and engineers of to-day; this frame is exceedingly and exceptionally well constructed, and the bracing of it is very interesting to note.

Quite an unusual transaction in connection with the contract for the new First Methodist Episcopal Church, Main and High Streets, Germantown, is worth mentioning, especially since the editors of this and other journals have been trying to convince the public that stone is better than terra-cotta, and *vice versa*. In this case the building was designed by Architects Rankin & Kellogg in the Perpendicular Gothic style of architecture, the body of the work was to be of Chestnut Hill local stone, and the trimmings, which were very elaborate and ornamental, were to be of gray terra-cotta.

In connection with the successful bid of Contractor Charles P. Nesbitt, of Philadelphia, was a proposal of a local stone-cutter, Mr. Reily, in which he offered to build the structure as designed by the architects, substituting Indiana limestone for the ornamental terra-cotta, and Holmesburg granite for the Chestnut Hill local stone, at a price which was several hundred dollars less than that asked by the terra-cotta companies. Mr. Reily's bid was accepted, and the original design is being carried out in stone instead of terra-cotta.

It appears from this transaction that either the price of cut stonework is to-day very much lower than formerly, or the terra-cotta companies, "in the exuberance of their zeal," are charging too much for their product.

WINDOW LEAD, FOR RESIDENCE AT PHILADELPHIA.
Baker & Dallett, Architects. Executed in Terra-Cotta by the Conkling-Armstrong Terra-Cotta Company.

October 5 witnessed the formal opening of Horticultural Hall on South Broad Street; Frank Miles Day & Brother, architects; a description of which has been given in previous letters. This is undoubtedly one of the finest of the recent brick and terra-cotta buildings of this city, and lovers of good architecture will not

soon tire of examining its exquisite design and detail work; it is an excellent example of Italian Renaissance, and its far overhanging roof of tile, treated in beautifully harmonizing color underneath, is generally admired.

MINNEAPOLIS.— The prospects are that we shall have a busy season beginning with the early spring, providing the pending election restores confidence in business circles. This estimate is based on the fact that much work has been planned but laid over until after this all-important event. In addition to this, there is much new work already being talked of. The finishing up of old work and the building of band-stands and grand-stands for the accommodation of the Grand Army Encampment, K. of P. Conclave, State Fair, and numerous other events (all of which have brought many visitors to our city) has given us the appearance of being very busy.

Two very substantial business blocks (one for the North Star Boot & Shoe Co., the other for the Wyman-Partridge Co.) are now being erected on opposite corners of one of our principal thoroughfares. Both of these buildings will be seven stories and fire-proof.

It is reported that the reorganization of the Northern Pacific Railway Company means a new union depot for Minneapolis,— certainly we need one.

W. H. Hayes, of this city, is architect for a Methodist Episcopal Church at Pekin, China, to cost $75,000.

ST. PAUL.— Practically the same state of affairs prevails here as at Minneapolis. Aside from a few large enterprises, there is comparatively little doing.

Architect Cass Gilbert, at regular monthly meeting of the Minnesota Chapter A. I. A., gave a detailed account of his experiments with cements and concreting for both the new capitol and the Northern Pacific Railway Company's new office building. He is making a series of exhaustive tests, which will furnish valuable and conclusive data for the future, not only as to methods, but also as to relative worth of various cements of domestic manufacture, several of which proved themselves worthy of entire confidence for every purpose. Mr. Gilbert is also testing three different methods of floor construction.

Mr. Gilbert secured second prize of $1,500 in the Montana Capitol Competition.

Evans & Howard will furnish the face brick for the New Northern Pacific office building.

PITTSBURG.— Among the contemplated work in this city may be mentioned that Architects Alden and Harlow have prepared plans for two of the branch libraries, one to cost $30,000, and the other $15,000. Plans are being prepared for a two-story granite and brick bank building for the Western National Bank, corner of Penn and 9th Streets. Architect Chas. Bickel has prepared plans for an eight-story stone, brick, and terra-cotta warehouse to be erected at the head of Federal Street on Fifth Avenue, to cost about $8,000. It will be constructed on the slow combustion principle. Architect E. C. Tritten, of Philadelphia, is preparing plans for a $30,000 two-story brick and terra-cotta school building in the East End. The Turtle Creek School Board have decided to build a schoolhouse to cost about $24,000. Architect S. Munch is preparing plans for a brick and stone club-house for the East End Republican Club. Architect V. Wyss Thalman has prepared plans for a dwelling to be erected on Linden Avenue, East End, for Mr. Richardson, to cost $10,000. Work has commenced on the $100,000 residence of Mr. A. M. Byers, of Allegheny. E. M. O'Neil is having built at Oakland forty three-story brick and stone dwelling-houses to cost $100,000.

STEINWAY HALL, CHICAGO.
Dwight H. Perkins, Architect.

ROCHESTER. — Building operations are "waiting until election's over," and as a result local architects are not busy.

Architect J. Foster Warner has let the contract for the erection of a $100,000 extension to Sibley, Lindsay & Carr's wholesale building; W. H. Gorsline has contracted for masonry. Same architect has prepared plans for a fine railway station to be built on Court Street for the Lehigh Valley Railway Company. He is also making plans for another for the Buffalo, Rochester & Pittsburgh Railroad. It is understood that both will be large and costly structures.

COLOR *vs.* DURABILITY.

FROM the architect's point of view, nothing is of greater importance in selecting bricks and terra-cotta than an even and uniform color. No matter how durable the materials may be, he will not select them unless they are of a good tint. That is, of course, well known to all clayworkers, and in order to fulfil the necessary requirements the maker does his utmost. But the time has now arrived when architects of the younger school are asking themselves whether in addition they ought not to demand something of a durable nature. They are also considering the question as to what constitutes a good color in the artistic sense. It is impossible for the manufacturer to put up with every little whim of the architect, but a strong feeling obtains at the present time that something should be done to improve the durability of the materials as well as to produce new tints. — *The British Brickbuilder.*

PLATE ILLUSTRATIONS.

PLATES 55, 56, 57, 58, 59, and 60 show the three lower and three upper stories, also the stage elevation of Steinway Hall, Chicago, Dwight H. Perkins, architect. It has a frontage of 61 ft., and is 91 ft. deep, surrounded on three sides by alleys, giving light all around. It is built to house the musical public. The first story is a piano salesroom occupied by the Steinways of New York. The second and third stories are one; they constitute the hall. It is arranged for chamber concerts, will accommodate an orchestra of forty

pieces on the stage, has a grand organ of fifteen hundred pipes, and will seat 750 people. The hall is elaborately decorated. The frieze over the arch is from Norse mythology, and represents the Death of Balder or the Passing of Summer. The fourth and fifth stories are piano salesrooms similar to the first.

The sixth, seventh, eighth, ninth, tenth, and eleventh are divided into music studios, singly and *en suite*, all especially arranged for their peculiar uses. On the seventh floor is a recital hall seating 250, and arranged for dramatic study and amateur performances.

The structure is steel covered with fire-clay tile and faced with pressed brick and terra-cotta. The front is in three shades of buff, — dark at the bottom, medium above — light for the shaft, and medium for the top or cornice story.

The architectural terra-cotta used was furnished by the Northwestern Terra-Cotta Company, while the front brick was supplied by Charles T. Harris.

Plate 62 shows the front elevation of the Loder Building, Philadelphia, Penn., erected after the plans of Mr. Charles Balderston, architect, Philadelphia, Penn.

The two fronts on Chestnut Street and 16th Street are built of mottled Pompeian bricks, furnished by O. W. Ketcham, the Philadelphia agent of B. Kreischer & Sons, New York.

The terra-cotta was made to match Indiana limestone.

This building contains a store occupying the entire first floor and five stories of offices, which can be used either singly or *en suite*.

A new feature in store interiors is the mezzanine floor or gallery, running around the store proper 9 ft. above the floor, thereby increasing the floor area greatly, and at the same time retaining the ceiling height at 18 ft. 3 ins.

Every attention has been given to make this building one of the most complete and thorough office buildings of its size in the country.

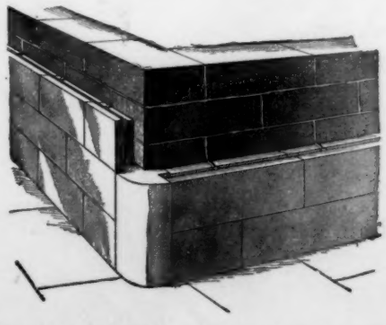
This building, considering the extremely narrow lot available, is an uncommonly successful specimen of the Renaissance, and Mr. Balderston is to be congratulated upon solving the problem in so neat a manner.

The general contractor for the building was Harrison C. Rea.

The masonry and bricklaying work was done by William R. Chapman & Sons.

THE accompanying illustration is of an enameled interlocking tile made by the American Enameled Brick and Tile Company, 14 East 23d St., New York, which is especially suited for interior finish work.

The brick or tiles are all grooved along the top and bottom edges; the walls of the lower groove being of even length, while the inner wall of the upper groove is shallower than the outer one. This allows the outer joints to be laid close, and at the same time leaves space enough between the inner walls for a nail which may be driven



at any point within the length of the tile where the same crosses a horizontal or vertical joint of the wall behind.

In bedding the tile, the cement seizes the nail and fills the groove, bonding all together and to the wall. Should the nail not drive as intended, it can readily be bent in the direction of the groove, and thus tend to hold it even more firmly.

The tiles are made to lay as standard English size brick, viz., 3 by 9 in. face, and being but 1¼ ins. thick save 2¾ ins. of needless brickwork wherever it is not necessary that enamel brick of 4½ ins. thickness be used to carry a load.

No. 12 wire nails, 1½ ins. long, are recommended for brickwork backing. Screws or shorter nails can be used where tiles are set as lining over wooden partitions to give the effect of an enameled brick wall, thus economizing materially in space as is often desirable in halls and vestibules, the gain being 3 ins. wherever thus used. Owing to the secure bond between the tiles effected by the cement tongue in the double groove, it is not necessary to nail each individual tile.

Internal and external bullnose and quoins are supplied for corners, and they are rabbeted to the tile as shown in cut, thus bonding one with the other to an intimate whole, and making displacement impossible except by fracturing the tiles. Special moldings for top of wainscoting, fastened in a similar manner, are also furnished.

WHAT OTHERS ARE DOING.

WALDO BROTHERS have closed contracts for each of the three new sections of the Subway. Alsen's cement will be used, as on most of the other sections.

J. MAIR STAVELEY has been appointed New England agent for the Oliphant & Pope Company, manufacturers of face brick, Trenton, N. J.

THE UNION AKRON CEMENT COMPANY, Buffalo, are furnishing the Akron Star Brand Cement for the concrete foundation for paving at Binghamton, N. Y.

THE DONNELLY TERRA-COTTA COMPANY, Berlin, Conn., will furnish the terra-cotta for the Young Men's Christian Association Building, Norwich, Conn., C. H. Preston, architect.

J. MAIR STAVELEY, agent of the Donnelly Terra-Cotta Company, has removed to 40 Water Street, Boston. In addition to architectural terra-cotta, Mr. Staveley carries a full line of face and common brick.

WALDO BROTHERS have closed a contract calling for about thirty thousand barrels of Brooks, Shoobridge & Co. English Portland cement, to be used on the piers for the new Charlestown (Boston) bridge, although the price was higher than on other brands.

CHARLES T. HARRIS, Lessee Celadon Terra-Cotta Company, is furnishing the roofing tile for the residence of D. J. Hubbard, Chicago, John P. Long, architect; the new Music Hall, Northwestern University, Evanston, Ill., W. A. Otis, architect; and the park shelter, Prospect Park, Brooklyn, Parfitt Bros., architects.

PERTH AMBOY TERRA-COTTA COMPANY, through Waldo Brothers' agents, have closed contracts for the Drexel House, Philadelphia, Peabody & Stearns, architects; Pope Building, Boston, Peabody & Stearns, architects; Proctor Building, Fulton Street, Boston, Winslow & Wetherell, architects; Bank Building, Newton, W. G. Preston, architect.

THE WHITE BRICK AND TERRA-COTTA COMPANY has just completed the terra-cotta for store and loft, 51 West 3d Street, New York City, L. Korn, architect; residence for P. Tiffany, at Westbury, L. I., W. J. Wallace, architect; and addition to Grammar School No. 75, C. E. J. Snyder, architect, and has closed the following contracts: State Normal School, Jamaica, L. I., J. G. Perry, architect; Court Exchange Building, Bridgeport, Conn., C. P. H. Gilbert, architect; residence at Newburgh, N. Y., Charles W. Romeyn, architect; storage warehouse, Brooklyn, J. G. Glover, architect; and apart-

ments, corner 21st Street and Ninth Avenue, New York City, C. P. H. Gilbert, architect.

THE BROOKE TERRA-COTTA COMPANY, Lazearville, W. Va., will furnish the buff brick used on the exteriors of the new Forsyth County Court House, at Winston, N. C., the new Court House at Charlotte, N. C., and the Court House at Wayne, N. C. A handsome residence has just been completed at Pittsburgh, Penn., in which their dark buff rock-faced ashlar was used. This same material will be used in a new residence being erected at Norfolk, Va.

This company is making a specialty this year of what they are pleased to term their No. 5 buff pressed brick, which is an especially fine light buff brick well suited for public institutions, churches, schools, and other large buildings.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., notwithstanding the general distress among manufacturing concerns, report that their plant is fairly well employed. At no time during the year have they run on short hours, and are now employing four hundred men, running ten hours six days a week. They have contracts on hand to keep their plant employed on full time for the next two months. Have no very large contracts on hand at the present time, but a great deal of small work. Some of these may be mentioned as follows: —

For the L. D. Brown & Son Co., Middletown, Conn., fire-proof power plant and also a new dye-house; steel framework for the Fire Department Building at Worcester, Mass.; power station for the electrical equipment of the N. Y., N. H. & H. R. R., at Stamford, Conn.; machine shop for the Baush & Harris Machine Tool Company, of Holyoke, Mass.; new building for the Woonsocket Electric Machine & Power Co., of Woonsocket, R. I.; new steel bridge for the town of Green, Me., including a second bridge for the Cabot Manufacturing Company at Brunswick, Me.; and smaller bridges at Auburn, Pembroke, Turner, Buckfield, and Bridgeton, Me.; a new iron roof for Randolph & Clowes, Waterbury, Conn.; steel bridge for Somerset Company, N. J., located at Finderne, besides other smaller contracts.

BRICK AND MORTAR.

THE employment of bricks for building purposes is of the greatest antiquity, and although the building materials used in the great edifices of Babylon may seem mean as compared with those employed in the stupendous palace-temples of Egypt, and even in the less massive edifices of Assyria, yet the Babylonians appear to have raised, with them alone, structures which excited the wonder and admiration of the most famous travelers of antiquity. The profuse use of color and the taste displayed in its combination added a charm to their gigantic beauty. The palaces and temples, as those of Nineveh, were erected on lofty platforms of brickwork. The bricks, as in Assyria, were either simply baked in the sun, or were burned in the kiln. The latter are of more than one shape and quality; some are square, others are oblong; some are of a dark red color, and others of a light yellow.

The Babylonians availed themselves of the building materials found in their locality. With the tenacious mud or clay of their alluvial plains, mixed with chopped straw, they made bricks, whilst bitumen and other substances collected from the immediate neighborhood furnished an excellent cement.

In modern brickbuilding the art seems to have attained the highest perfection, and nothing beautifies a brick front more than the use of tinted mortar, which may be prepared by using the AMERICAN SEAL Mortar Colors — made in four beautiful tints. The additional cost is but trifling, and gives the work a far more artistic appearance. William Connors, of Troy, N. Y., manufactures these goods, which have a large and increasing sale throughout the United States.

No known material is more suitable for a building than brick, and when bonded with stone makes the most durable structure known to the art.

The AMERICAN SEAL Mortar Colors are shipped F. O. B. from New York City, Chicago, St. Louis, and Troy, and the branch houses are located at 99 Peck Slip, New York City, 243 Lake St., Chicago, and 407 North 12th St., St. Louis. Manufactured at Troy, N. Y.

The best and most attractive

FIREPLACE MANTELS

Are those made of our ornamental brick.

They are far better than other kinds, and don't cost any more.
Any good brick mason can set them up.

We offer a choice of six colors at

$15.00 and upwards.

Our sketch-book containing 40 designs
will be sent free on application.

Phila. & Boston Face Brick Co.,

No. 15 Liberty Square, Boston, Mass.